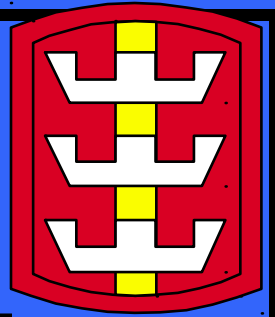




RIVER CROSSING OPERATIONS

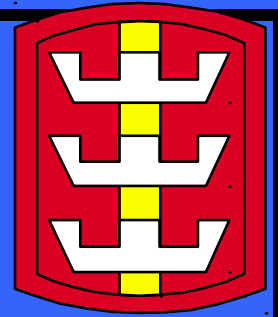


14 FEBRUARY

1STAFF



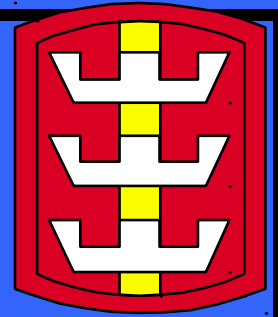
TERMINAL LEARNING OBJECTIVE



- **TASK:** Plan River Crossing Operations.
- **CONDITIONS:** In a classroom, given FM 90-13,
- **STANDARD:** Plan river crossing operations IAW FM 90-13.



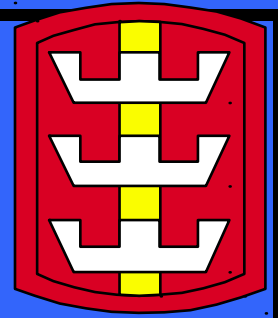
SAFETY, RISK, AND ENVIRONMENTAL CONCERNS



- **Safety Considerations:** **None**
- **Risk Assessment Level:** **Low**
- **Environmental Considerations:** **None**



PRIMARY REFERENCES

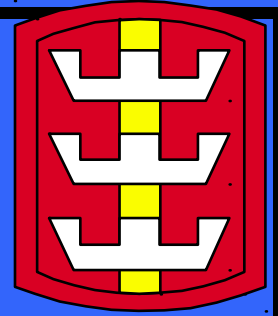


- FM 90-13, River Crossing Operations
- Website:

<http://www.wood.army.mil/engrmag/bridging/toc.htm>.



AGENDA

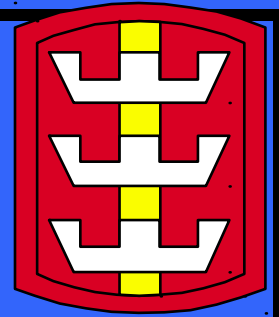


- Categories.
- Fundamentals.
- Command and Control.
- Engineer Planning



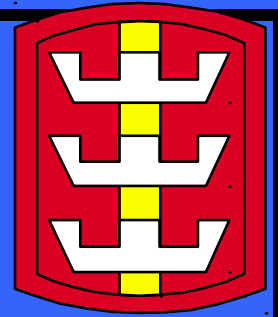


CATEGORIES OF RIVER CROSSING OPERATIONS





HASTY

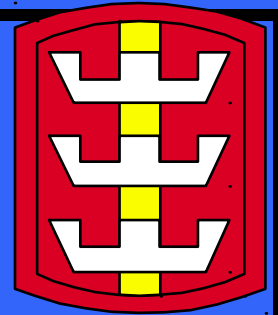


- Continuation of the attack.
- No pause.
- Types:
 - Dry-gap.
 - Wet-gap.

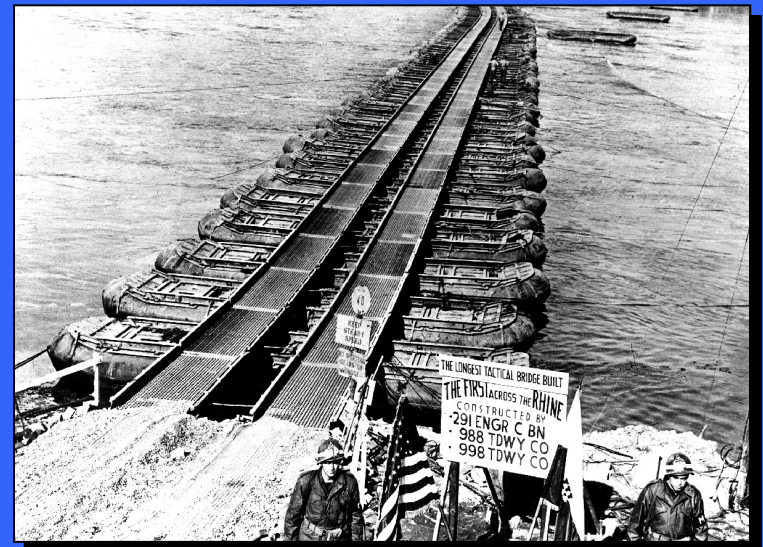




DELIBERATE

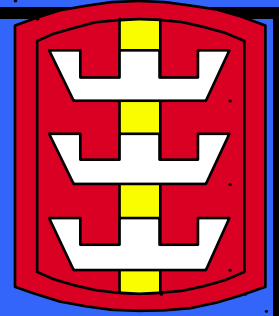


- Corps and division.
- Hasty crossing is not feasible, failed, or renewing offensive operations.
- Halt to make detailed preparations.
- Intent is to seize a final objective.
- Requirements:
 - Detailed planning and prep.
 - Centralized control.
 - Extensive rehearsals.
- Types:
 - Dry-gap.
 - Wet-gap.





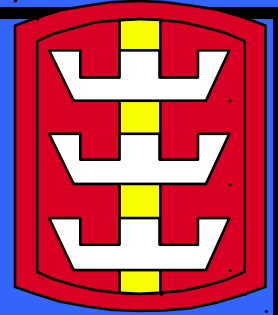
RETROGRADE



- **Movement to the rear across a water obstacle while in contact with the enemy.**
- **Failure to execute accordingly can lead to the loss of the entire force.**



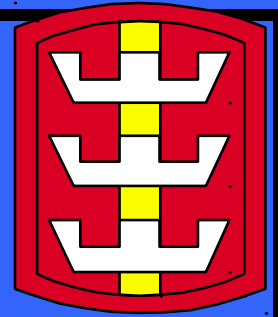
RETROGRADE



- **Delay:**
 - Trade space for time.
 - Three sub-phases (delay, crossing, defense).
- **Withdrawal:**
 - Disengage from the enemy.
- **Retirement:**
 - Movement away from the enemy, but not in contact with him.



FUNDAMENTALS

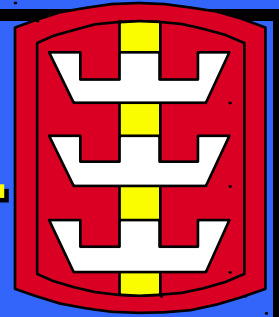


- Surprise.
- Extensive preparation.
- Flexible plan.
- Traffic control.
- Organization.
- Speed.





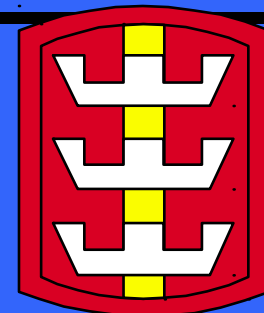
COMMAND AND CONTROL



- **ORGANIZATION**
- **CONTROL ELEMENTS**
- **CONTROL MEASURES**
- **CROSSING PLAN**



ORGANIZATION



**Crossing
Force**

**Bridgehead
Force**

**Breakout
Force**

**Mvr Support
Forces**

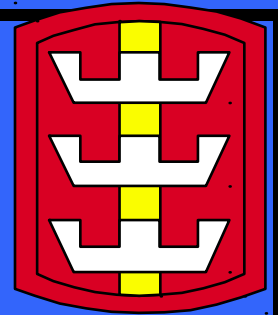
**Assault
Force**

**Assault
CO**

**Corps Combat Engineers
Bridge Companies
Military Police
Chemical**



CONTROL ELEMENTS



1

DTAC



- Close Fight
- Crossing Force HQ

1

DMAIN



- Planning
- Deep Op
- Traffic Control Cell (ACoSG4)

Crossing Force Cdr (CFC)
Crossing Force Engineer (CFE)

1

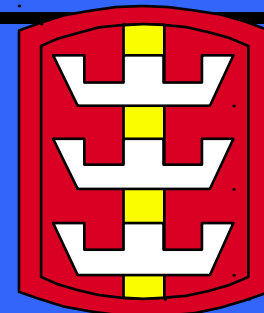
DREAR



- Sustain
- Post Crossing Control



CONTROL ELEMENTS



1 BTAC 1

- Advance to
- Attack across

Assault/Brhd
Force

1 BMAIN 1

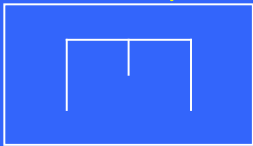
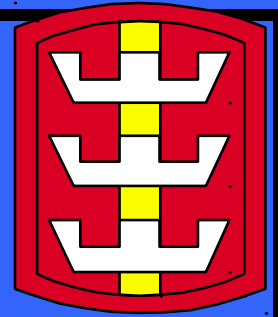
- Planning
- Traffic Control Cell (S4/MP/Engr)

Crossing Area Cdr (CAC)
Crossing Area Engineer (CAE)

Mvr Support
Forces



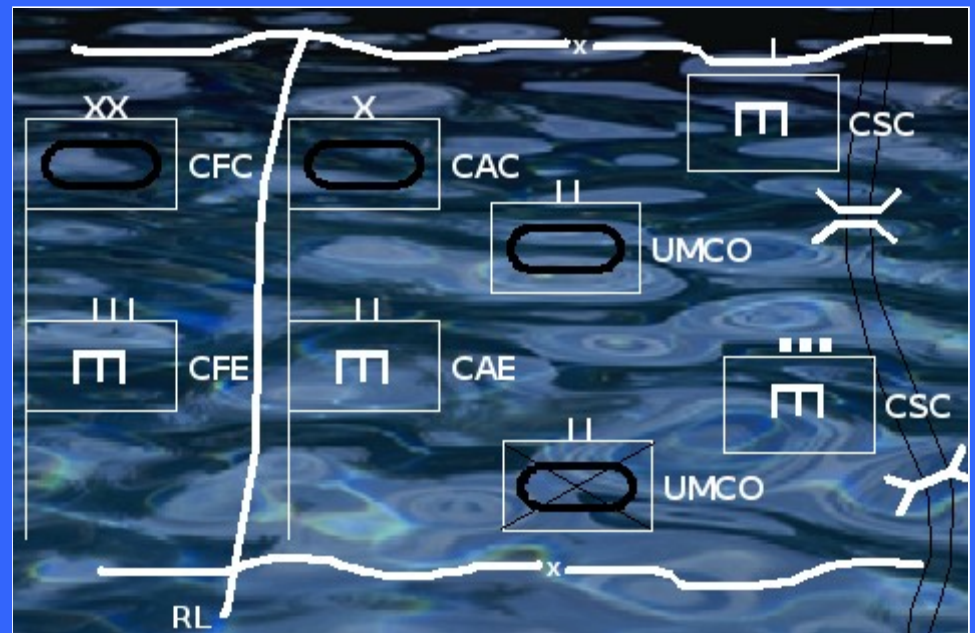
CONTROL ELEMENTS



- Crossing Site Cdr (CSC)
- Engineer CO Cdr/Plt Ldr

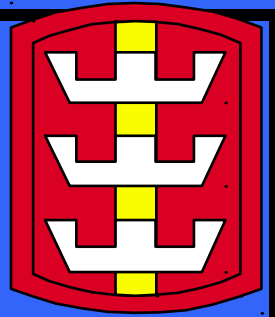


- Unit - Movement - Control Officer
- Each Battalion or separate Company

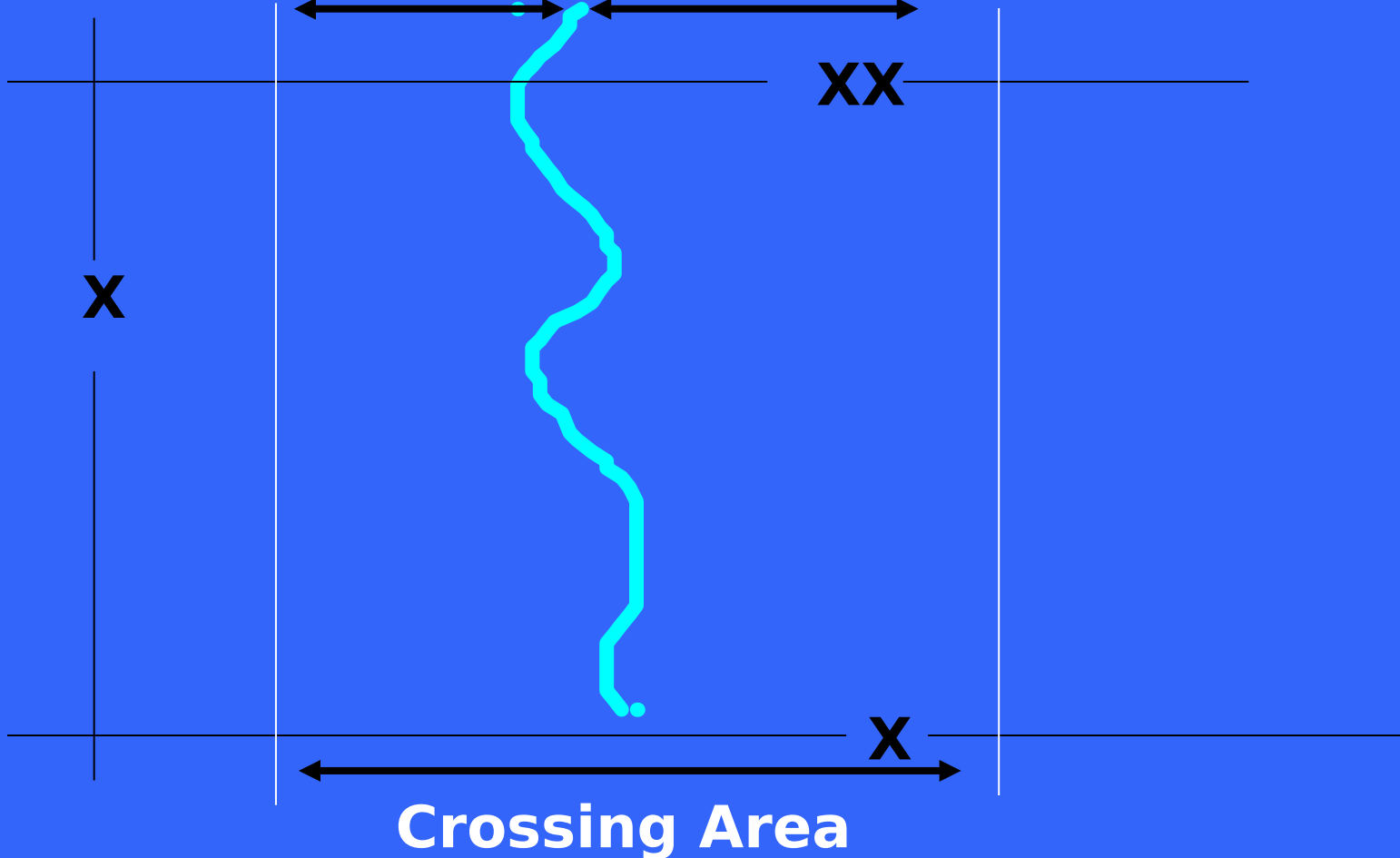




CONTROL MEASURES

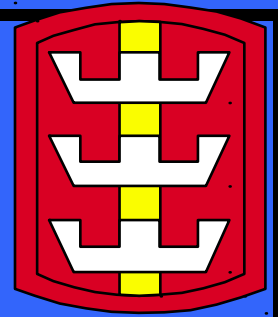


RL 3-4 km 3-4 km Release Line





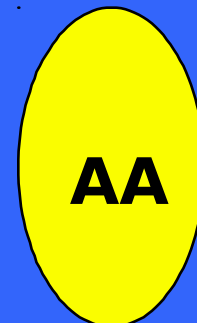
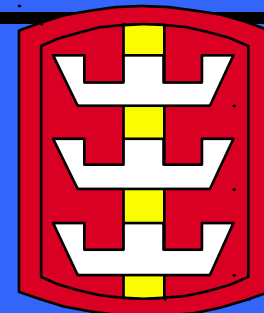
WAITING AREAS



- **ASSEMBLY AREAS**
- **STAGING AREAS**
- **CALL FORWARD AREAS**
- **HOLDING AREAS**
- **ATTACK POSITIONS**



ASSEMBLY AREA

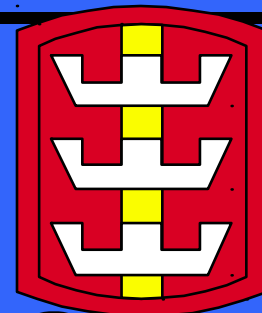


**“Areas in which a force
prepares or regroups
for further action”**



STAGING AREA

RL



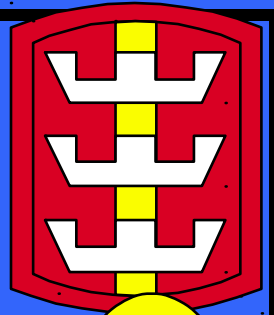
AA

SA

- **Size**
- **Location**
- **Movement Control (In/Out)**
- **Briefings**



CALL-FORWARD AREA



RL

CFA

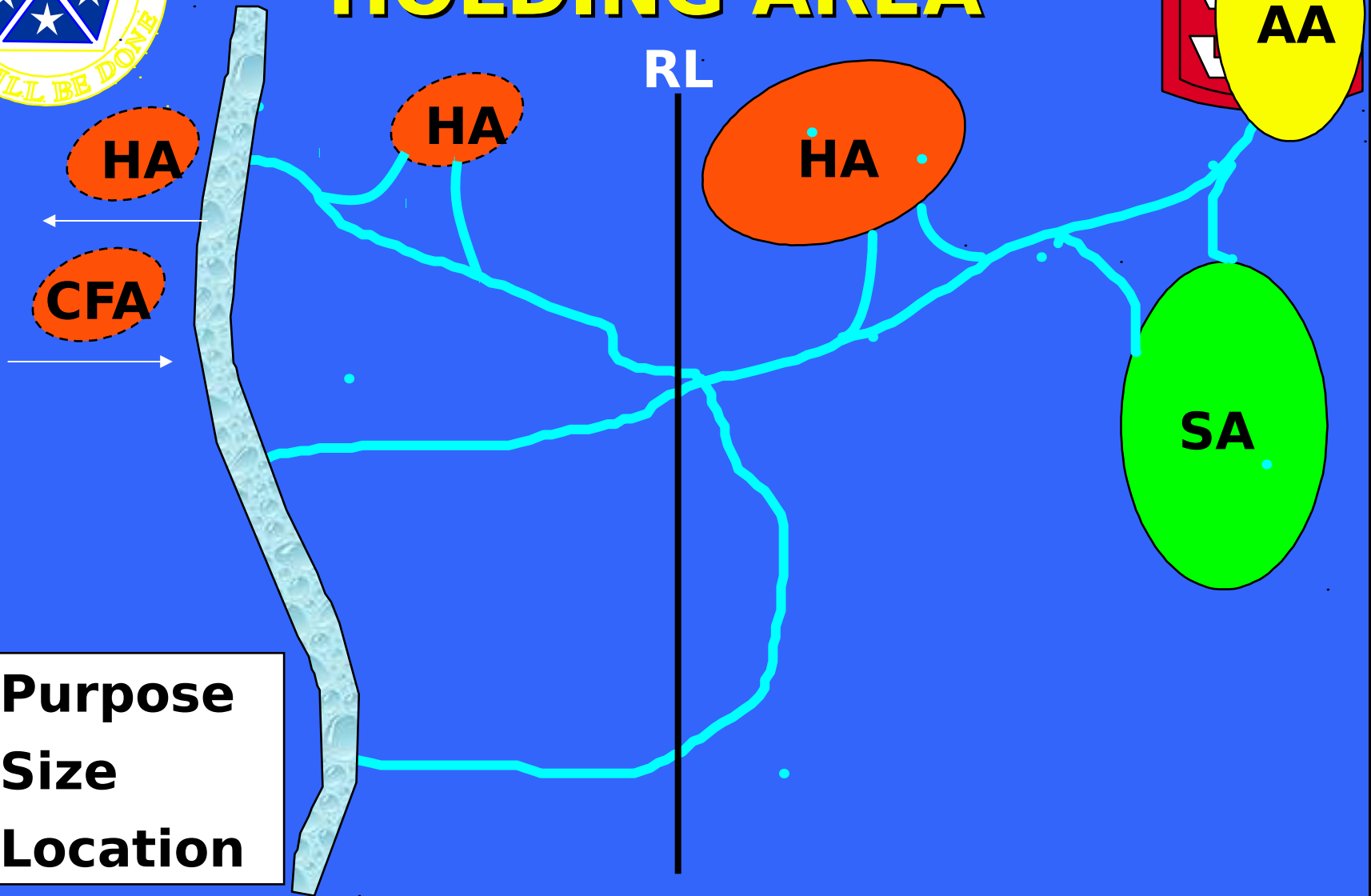
AA

SA

- Size
- Location
- Purpose
- Movement Control (In/Out)
- Allocation
- Co-located with ERP



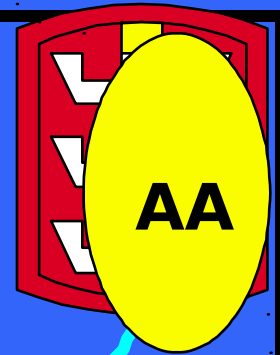
HOLDING AREA



- Purpose
- Size
- Location



ATTACK POSITION



CFA

HA

AP

AP

AP

AP

SA

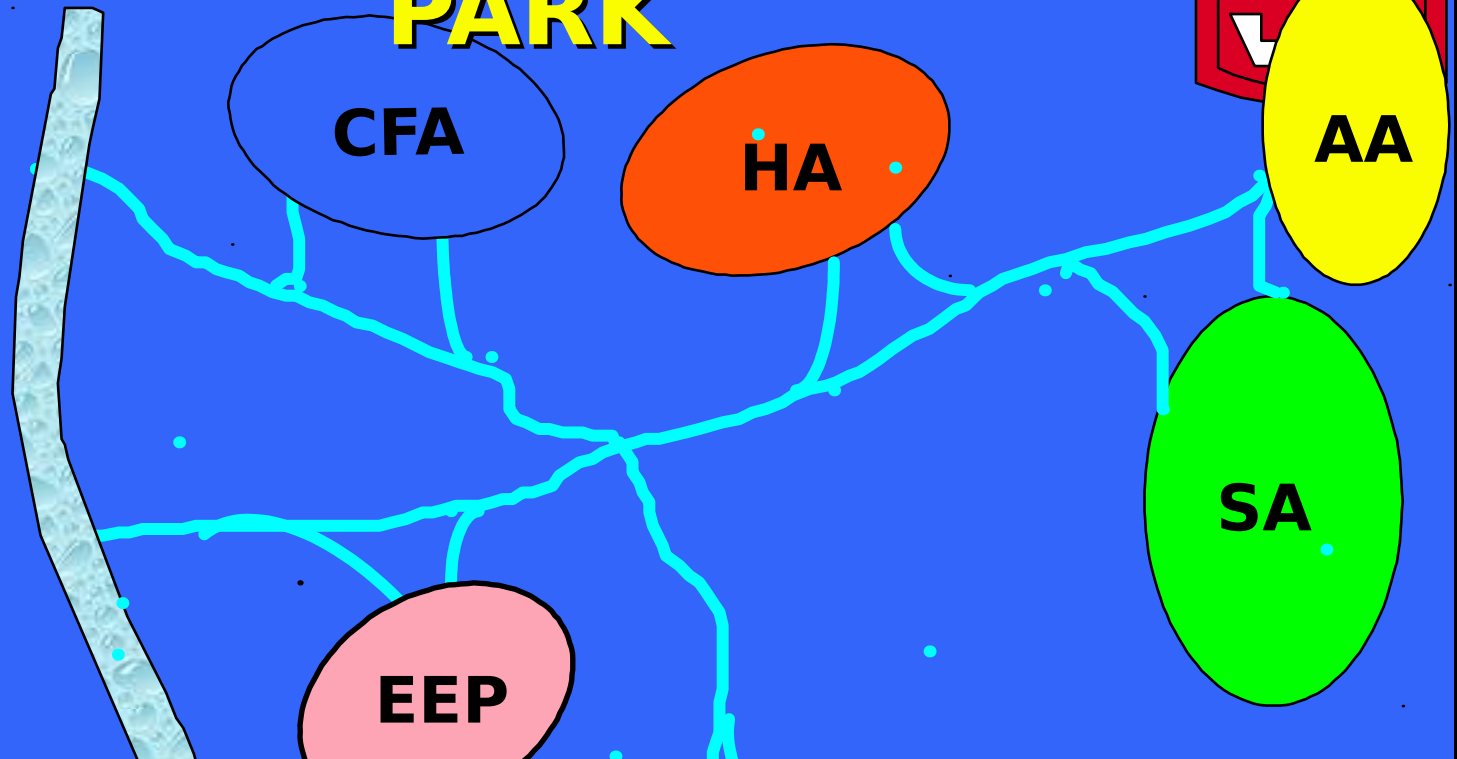
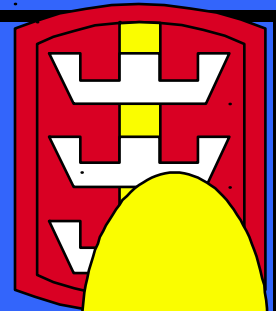
- Last position occupied or passed through by the assault echelon or attacking force before crossing the line of departure.
- Within the bridgehead, the attack position is the last position before leaving the crossing area or

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ENGINEER
SECTION



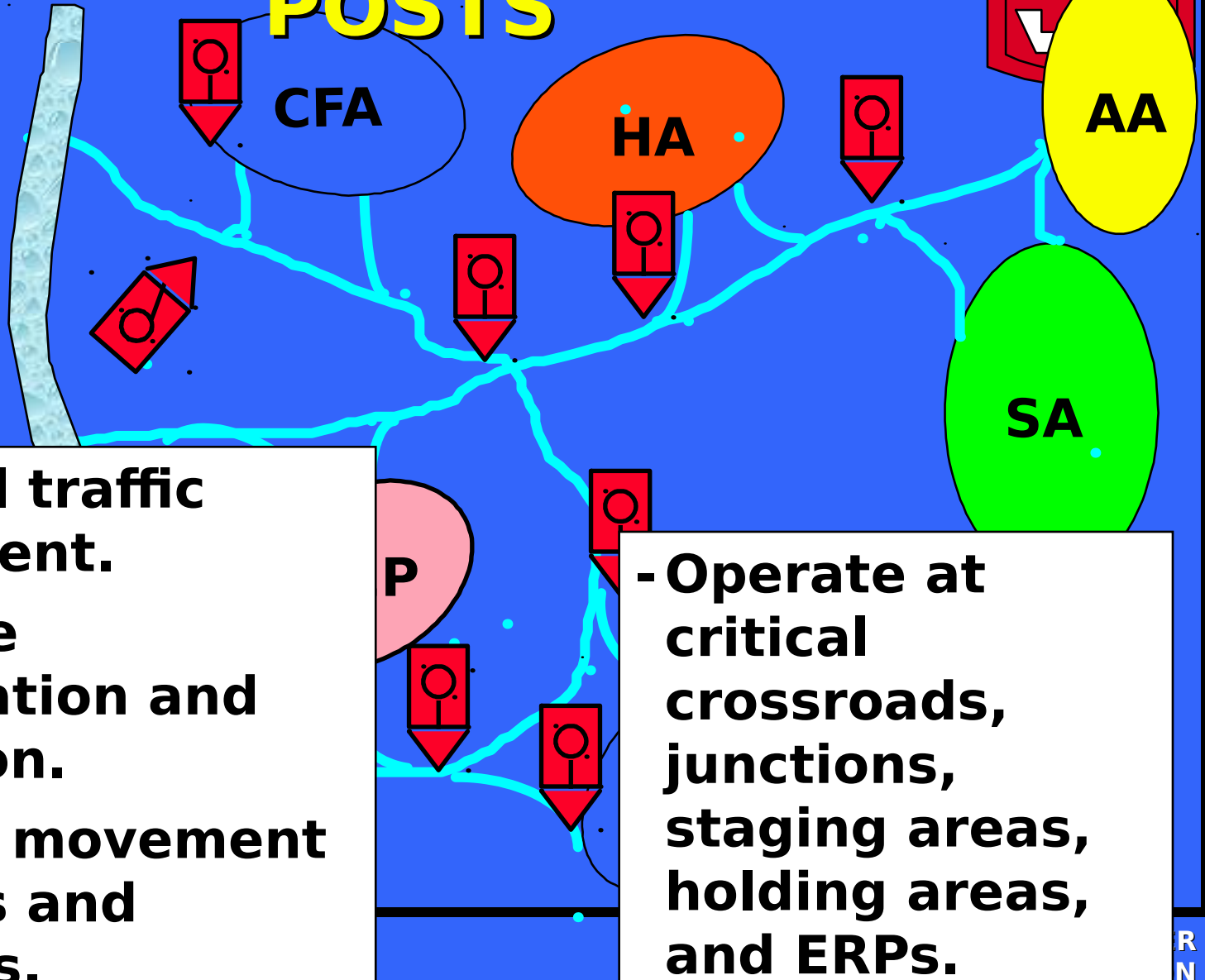
ENGINEER EQUIPMENT PARK



- **Purpose:** Assemble, prepare, store bridge equipment
- **Location**
- **Routes**



TRAFFIC CONTROL POSTS



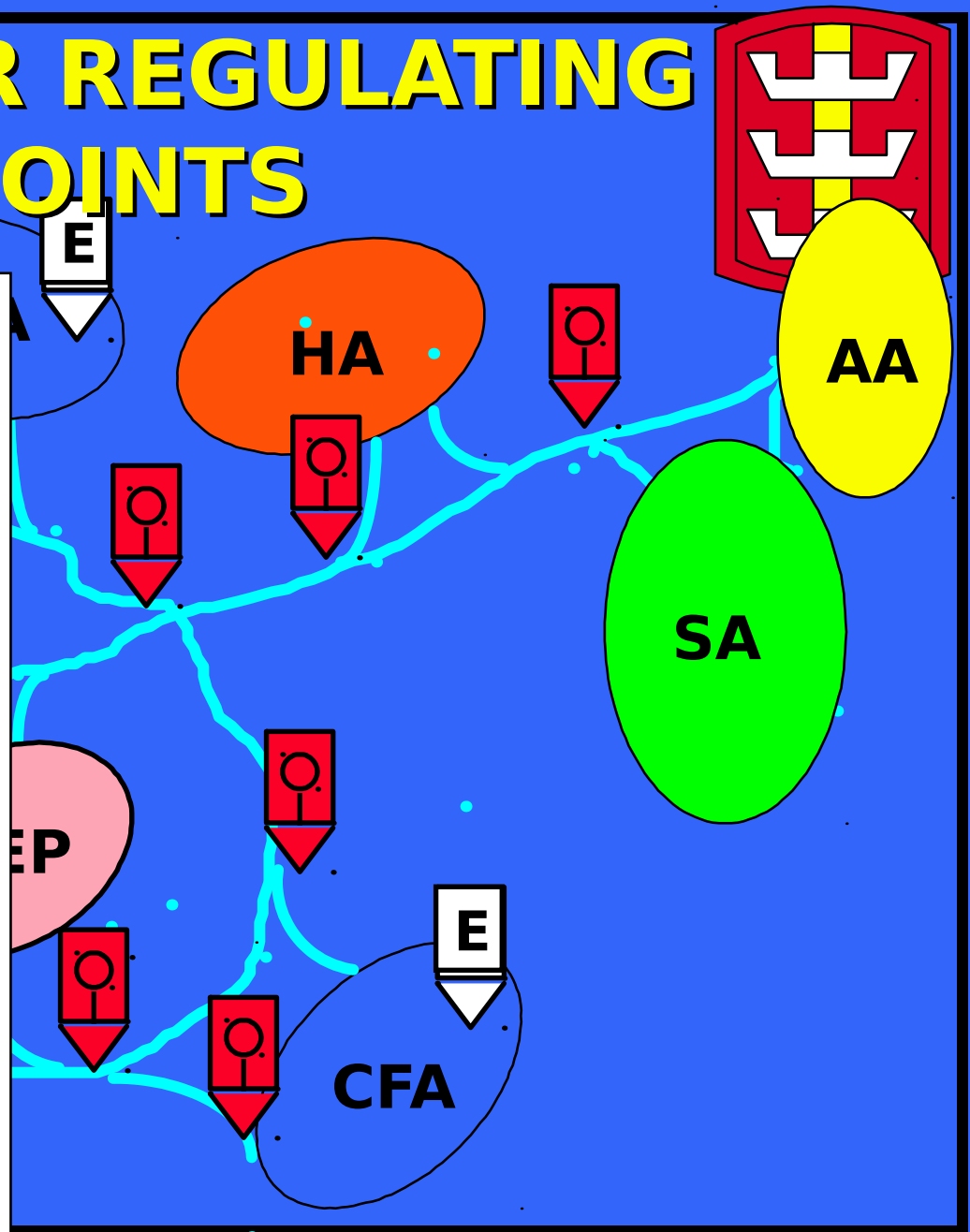
- Control traffic movement.
- Provide information and direction.
- Report movement of units and convoys.

- Operate at critical crossroads, junctions, staging areas, holding areas, and ERPs.



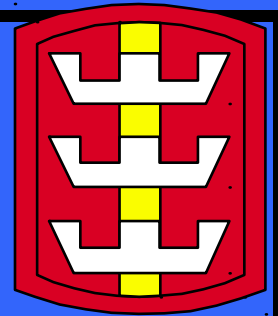
ENGINEER REGULATING POINTS

- Ensure vehicles do not exceed capacity of crossing means.
- Help maintain flow, speed, and interval.
- Give drivers final instructions on site-specific procedures.
- Each crossing site requires an ERP





ENGINEER REGULATING POINT



Raft loads:

- Mock raft.
- Maintain unit integrity.

Maintain commo with MPs, crossing site, and Cdr.



ERP Location:

- Provides space
- Near routes and accessible.

MPs direct traffic into

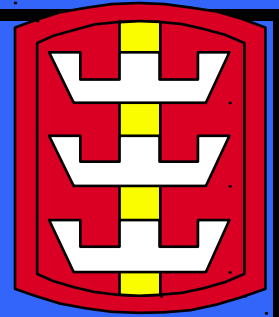
Check vehicles:

- MLC.
- Divert over class
- Brief crews.

Equipment needed: field phone, PRC, engr tape, traffic cones flash/chemical lights, chalk, camouflage nets /poles/signal flags.



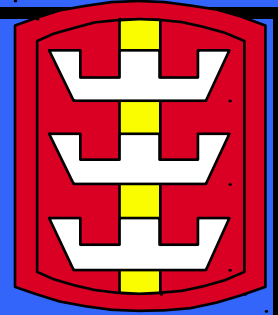
RIVER CROSSING TERMS



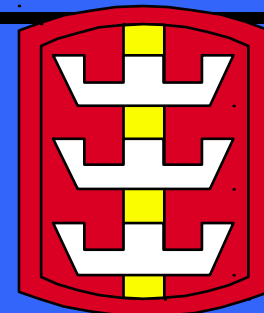
- **Bridgehead**
 - Intent
 - Depth
- **Far Shore Objective(s)**
 - secured by Assault Force(s)
 - Intent



RIVER CROSSING TERMS



- **Exit Bank Objective(s)**
 - Intent
- **Intermediate Objective(s)**
 - Inetnt
 - Crossing Area expansion
- **Bridgehead Objective(s)**
 - points where the lead brigade elements secure the bridgehead line and control avenues of approach to the bridge head

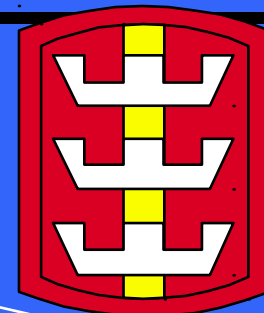


**Final
Objective**

**Bridgehead
Objectives**

Bridgehead

Bridgehead Line



XX

RL

Far-Shore
Objective

X

Crossing
Area(s)

Intermediate
Objectives

Exit-Bank
Objectives

XX

RL

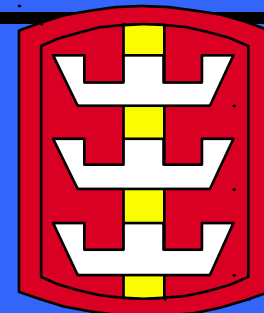
RL

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PHASES OF A RIVER CROSSING

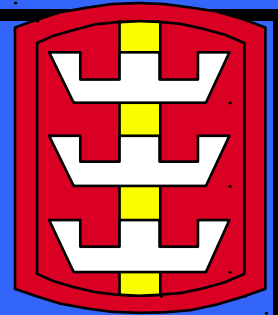


- Advance to the river.
- Assault across the river.
- Advance from the exit bank.
- Secure the bridgehead line.

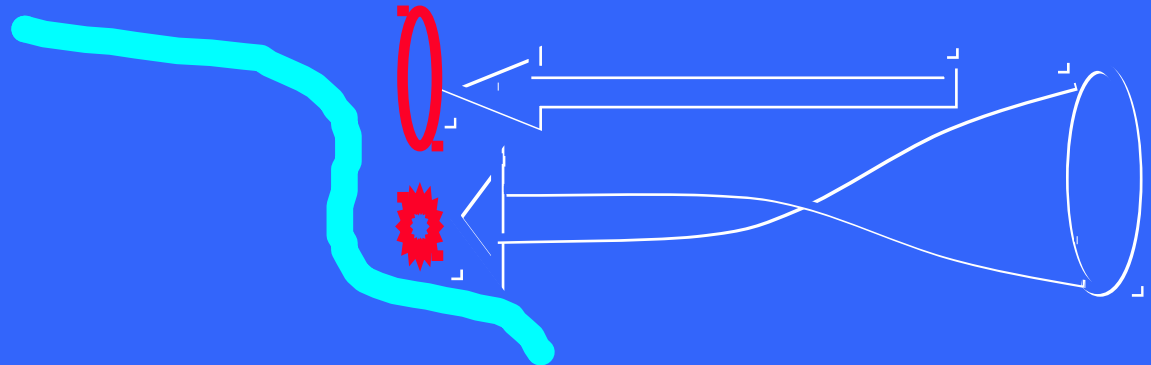




PHASE I - ADVANCE TO THE RIVER



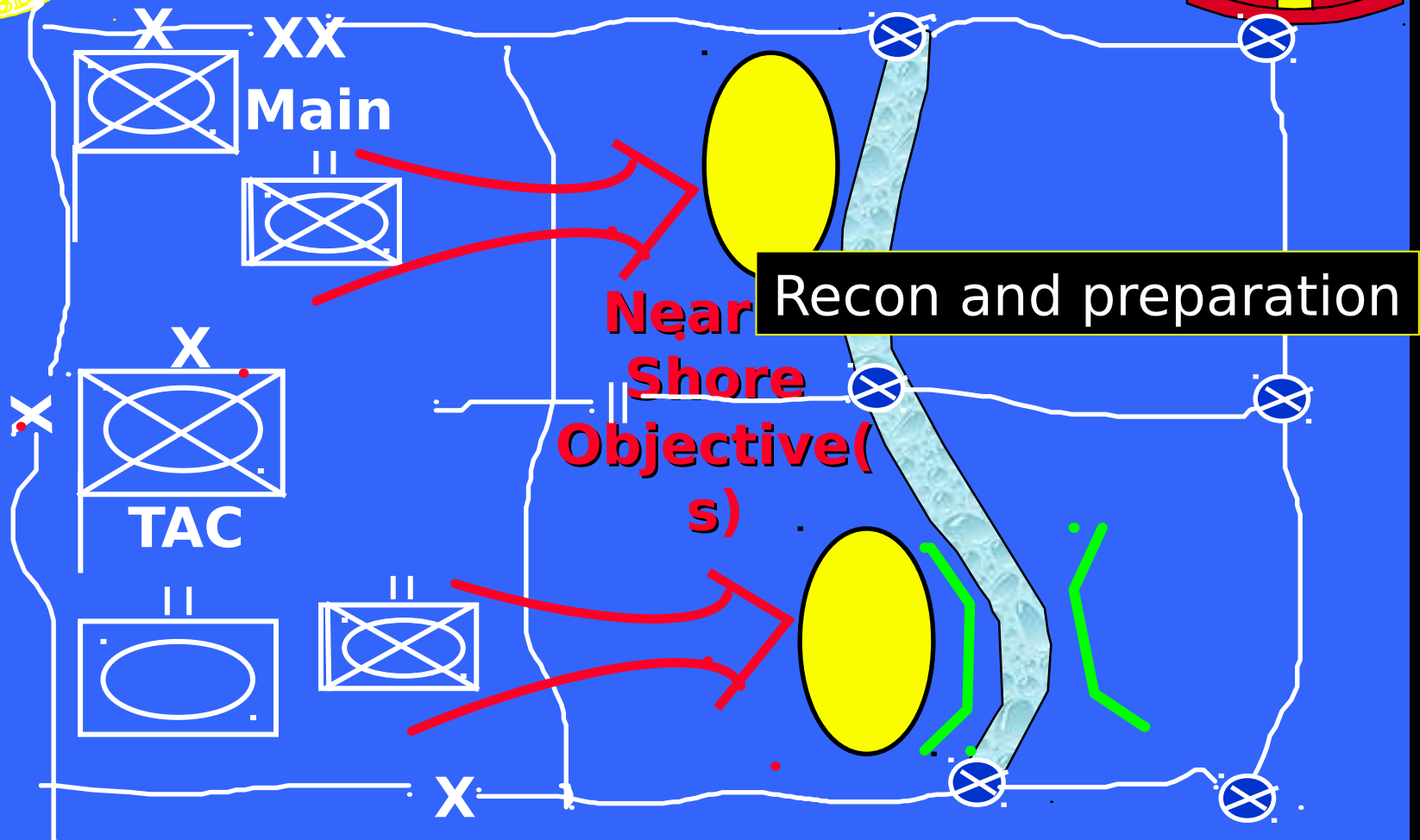
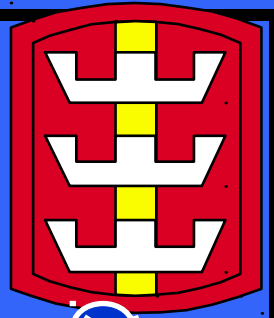
- **Purpose:** Attack to seize and secure terrain on near shore.



- **Once near shore is secured:**
 - Maneuver Support Force marks routes, establishes waiting areas, ERPs, and TCPs.
 - Bridgehead Force seizes attack-by-fire positions and prepares for assault.
 - Breakout Force moves into AA for passage through crossing area.

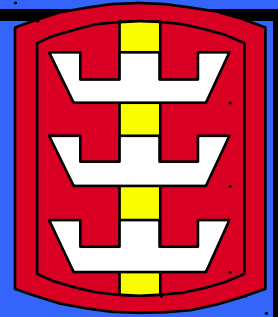


ADVANCE TO THE RIVER

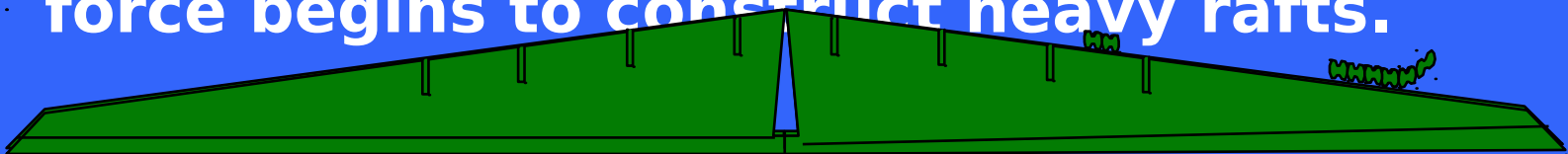




PHASE II - ASSAULT ACROSS THE RIVER

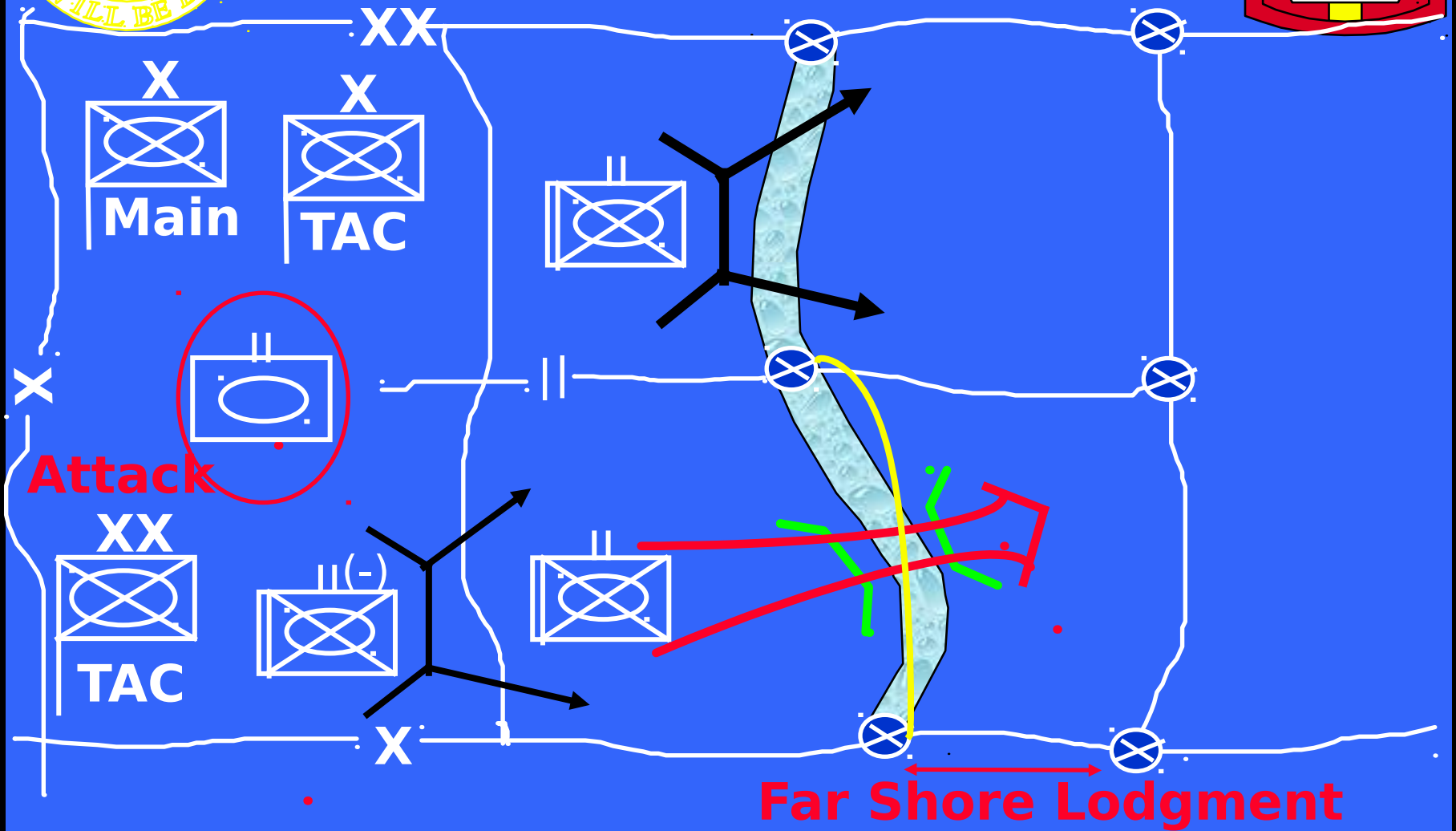
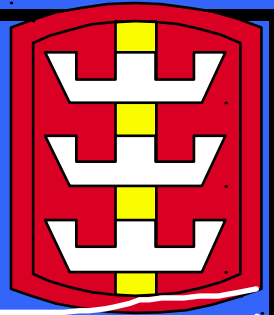


- To secure a lodgment on the far shore and eliminate direct fire on the crossing sites.
- Maneuver Support Force controls obscuration of the river
- Once far shore lodgment is secure, the crossing area is activated and the support force begins to construct heavy rafts.





ASSAULT ACROSS THE RIVER

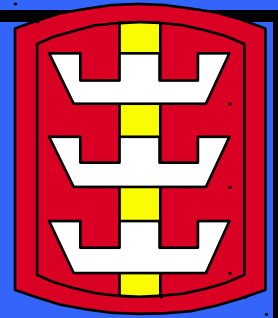


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36STAFF ENGINEER
SECTION



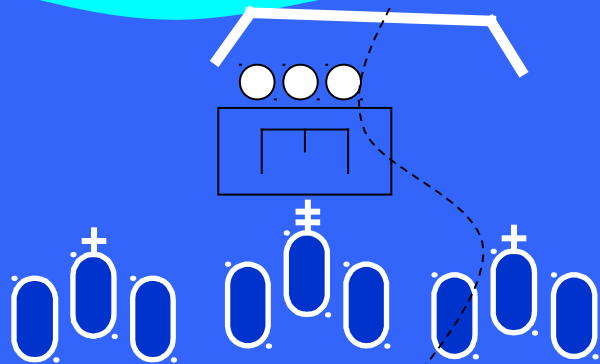
ASSAULT CROSSING SITE



300m

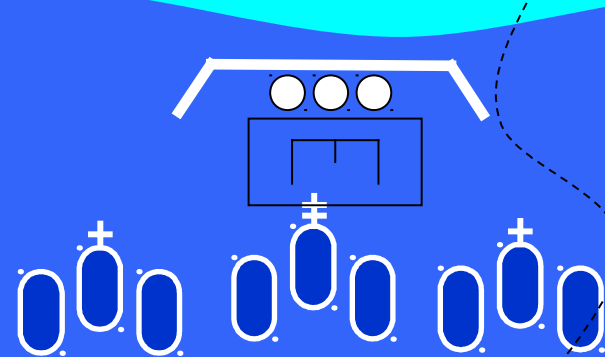
200m

200m



Atk Posn

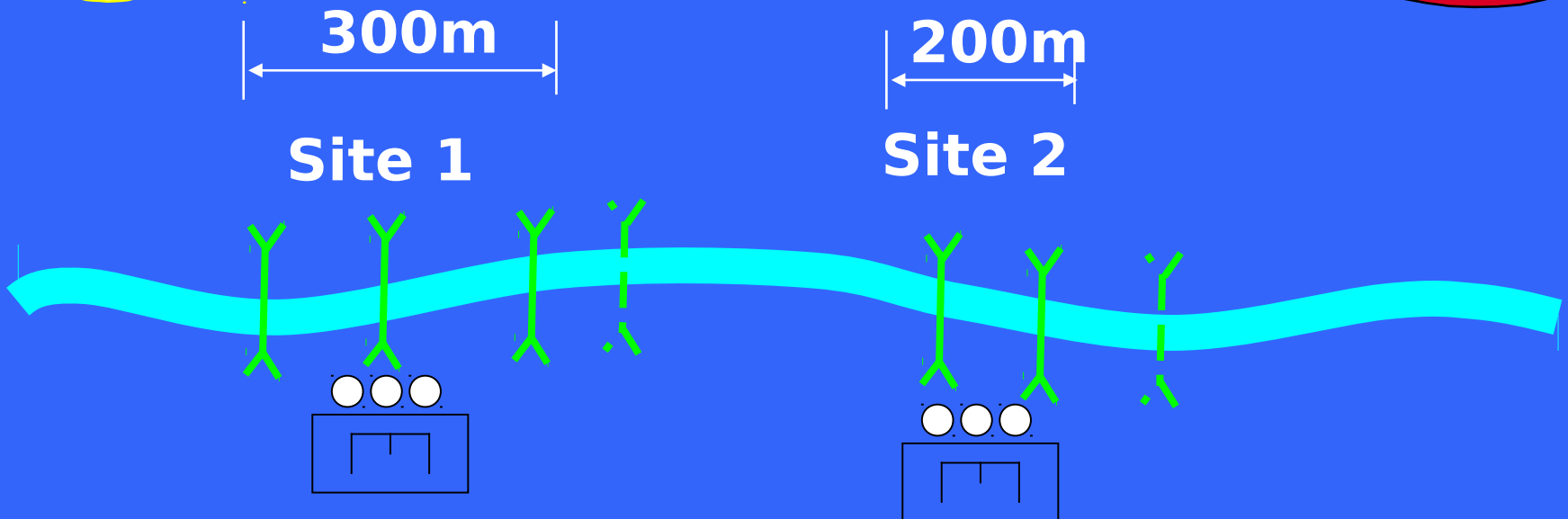
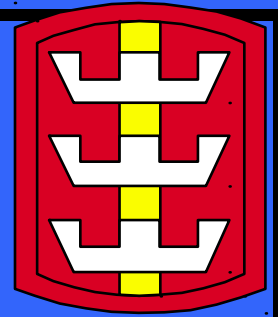
BOLP



Atk Posn



RAFTING SITES



Min 2 x rafting sites for each forward Brigade

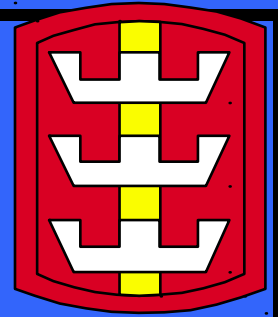
Site separation: 300M

1 x CL/100 of frontage

1 x alternate CL/site



PHASE III - ADVANCE FROM THE EXIT-BANK

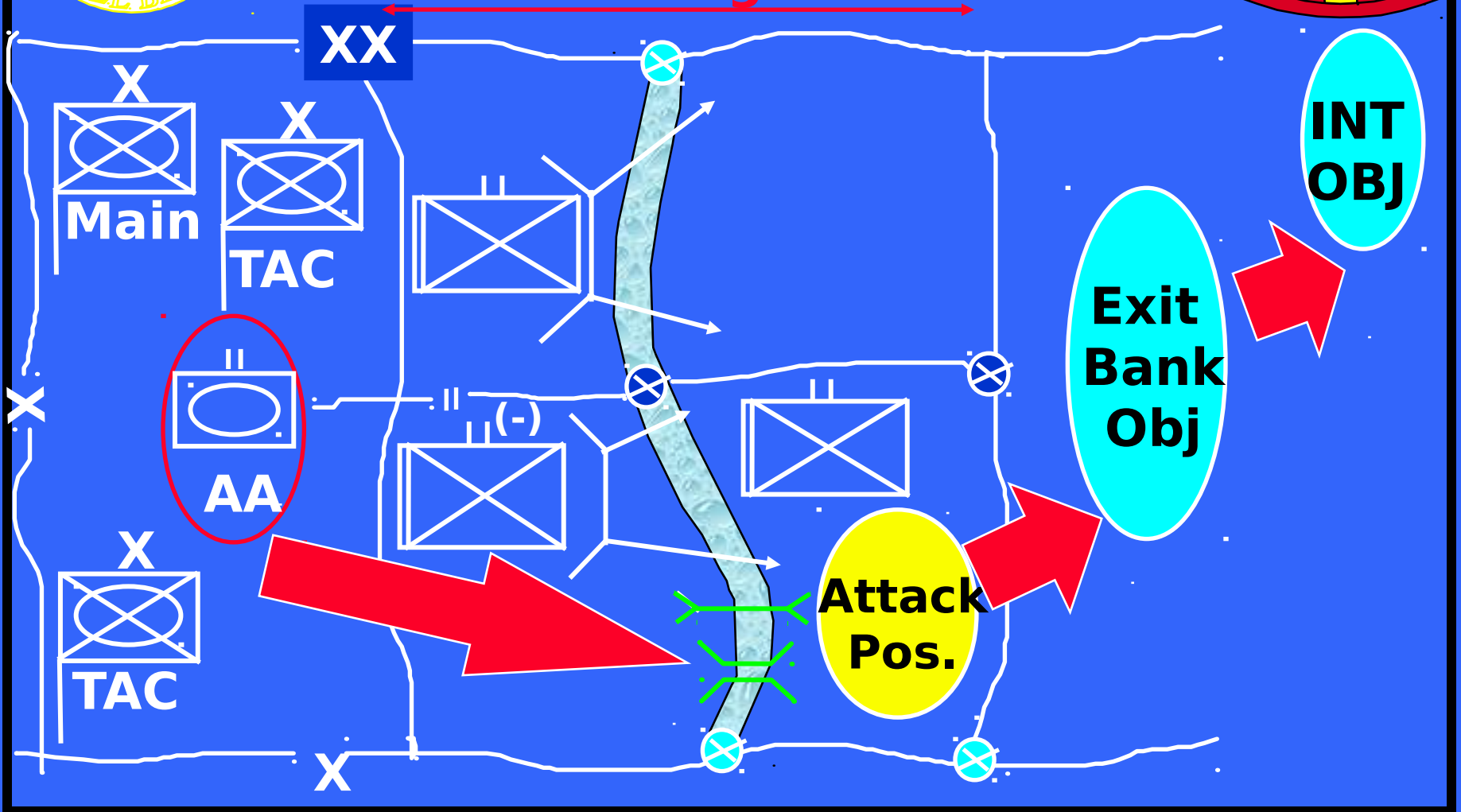
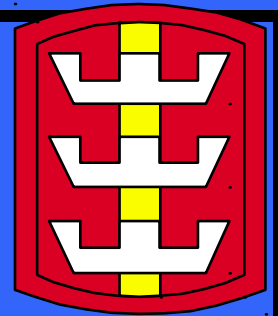


- **Purpose: To eliminate direct and observed-indirect fires from the crossing area.**
- **Bridgehead force seizes exit-bank objectives and intermediate objectives.**
- **Support force converts rafts to bridges after observed-indirect fires are eliminated from the crossing area.**



ADVANCE FROM THE EXIT-BANK

Crossing Area

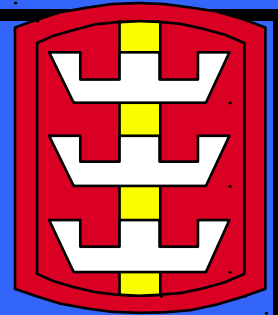


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SECTION



PHASE IV - SECURE THE BRIDGEHEAD LINE

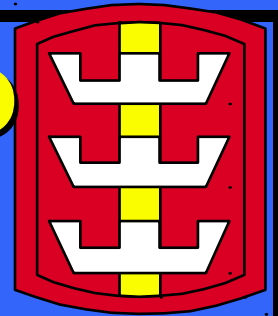


- Purpose: To seize the bridgehead objectives, in order to protect the bridgehead against CATK and to create time and space for the breakout on the far side of the river.
- Far shore phase line (RL) moves past intermediate objectives.
- Breakout Force moves to attack positions on the far shore.
- Specific raft/bridges are designated for full-time return traffic.

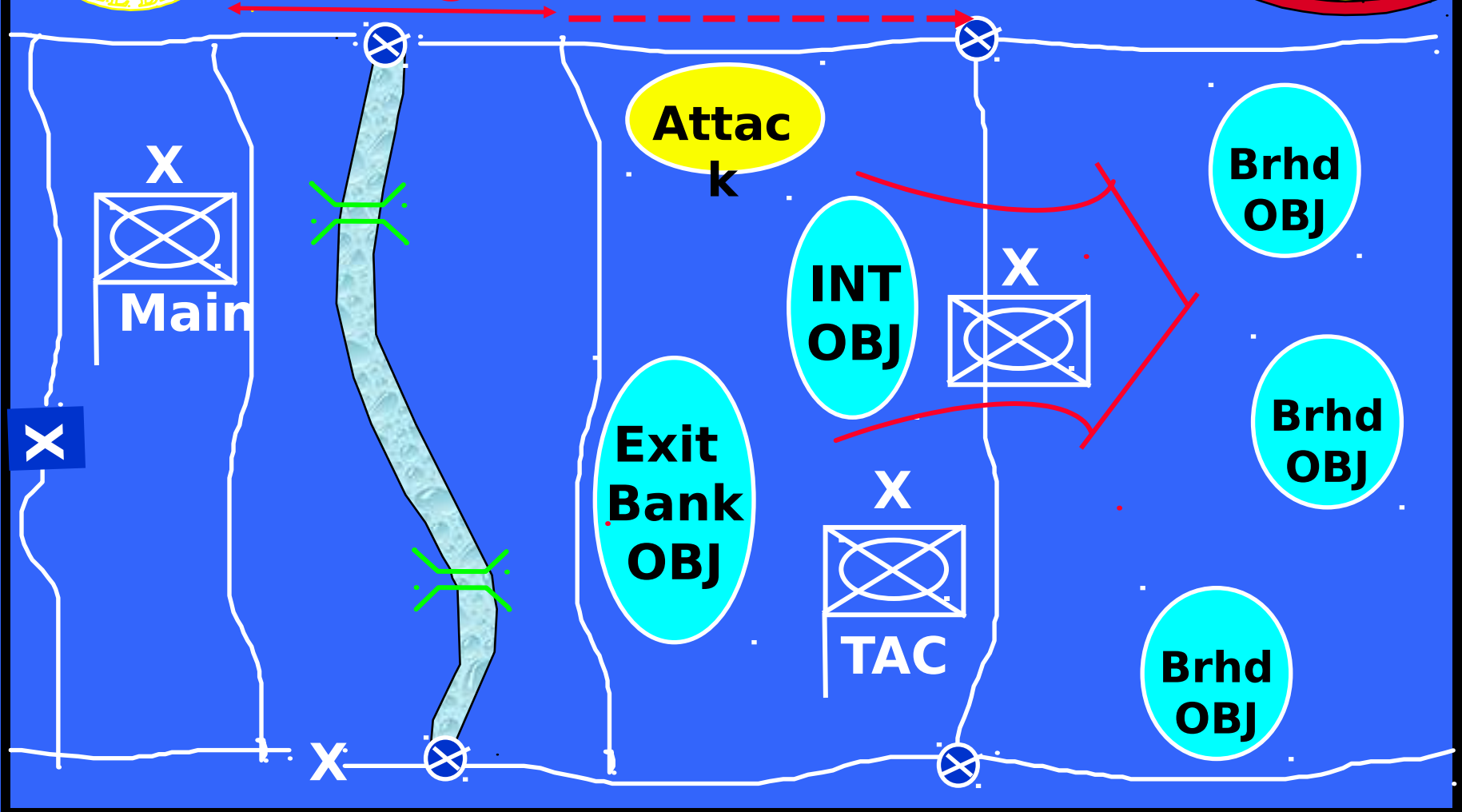




SECURE THE BRIDGEHEAD LINE



Crossing Area

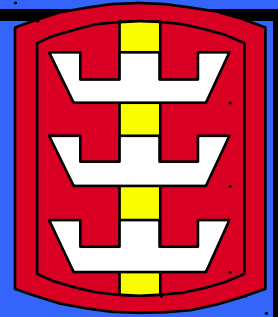


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42STAFF ENGINEER
SECTION



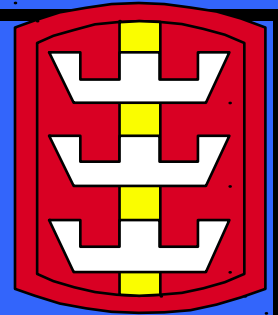
CONTINUATION OF THE ATTACK



- **Not a phase.**
- **Once bridgehead is secure the river crossing is complete.**
- **Crossing area control passes to corps.**
- **Breakout Force attacks out of bridgehead.**
- **Bridgehead Force reorganized and prepares to follow the Breakout Force.**
- **Security Forces from corps relieve the Bridgehead Force and secure the bridgehead.**



PLANNING RULES OF THUMB



● BOATS

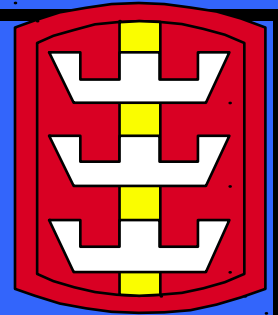
- Main attack brigade requires 31 assault boats to cross three companies in first wave. With 70 boats it can cross two battalions at once.
- IBRB15:
 - One per Infantry squad.
 - Three per Infantry platoon.
 - Nine per Infantry company.

● RAFTS

- Every forward brigade should have at least two raft sites.
- Raft sites should be no closer than 300 meters.
- Each raft site has 1-3 active centerlines and at least one alternate centerline.
- Raft centerlines are spaced 100-300 meters apart.



PLANNING RULES OF THUMB



- **BRIDGES**

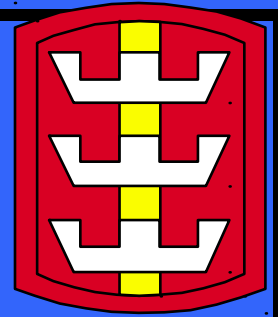
- Float bridges have a crossing rate of 200 vehicles/hour.

- **ASSETS**

- Bde/Div requires $1/2 \times$ Float Bridge Company(ies)/100m river width.
- Division river crossing normally requires 1 corps engineer group, consisting of 2 corps engineer battalions and 2 float bridge companies for each lead brigade.
- Each CFA requires 1 engineer squad to operate the ERP.
- First two hours: Bridge company can operate 6 rafts simultaneously. Afterwards: Only 5 rafts at a time (due to maintenance and refueling).



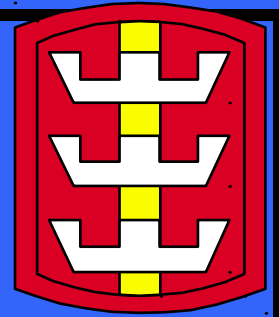
PLANNING RULES OF THUMB



- **TERRAIN**

- Crossing areas normally extend 3-4 km on each side of the river.
- EEPs are at least 1 km from the river.

- See Appendix A and B, FM 90-13.

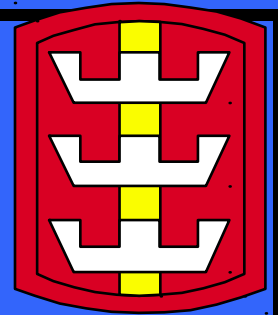


Engineer Planning Process

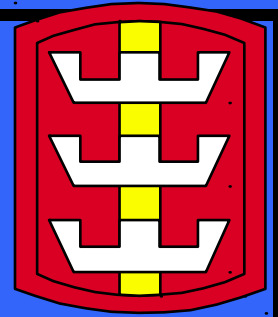
FM 90-13, Appendix B



BRIGADE PLANNING



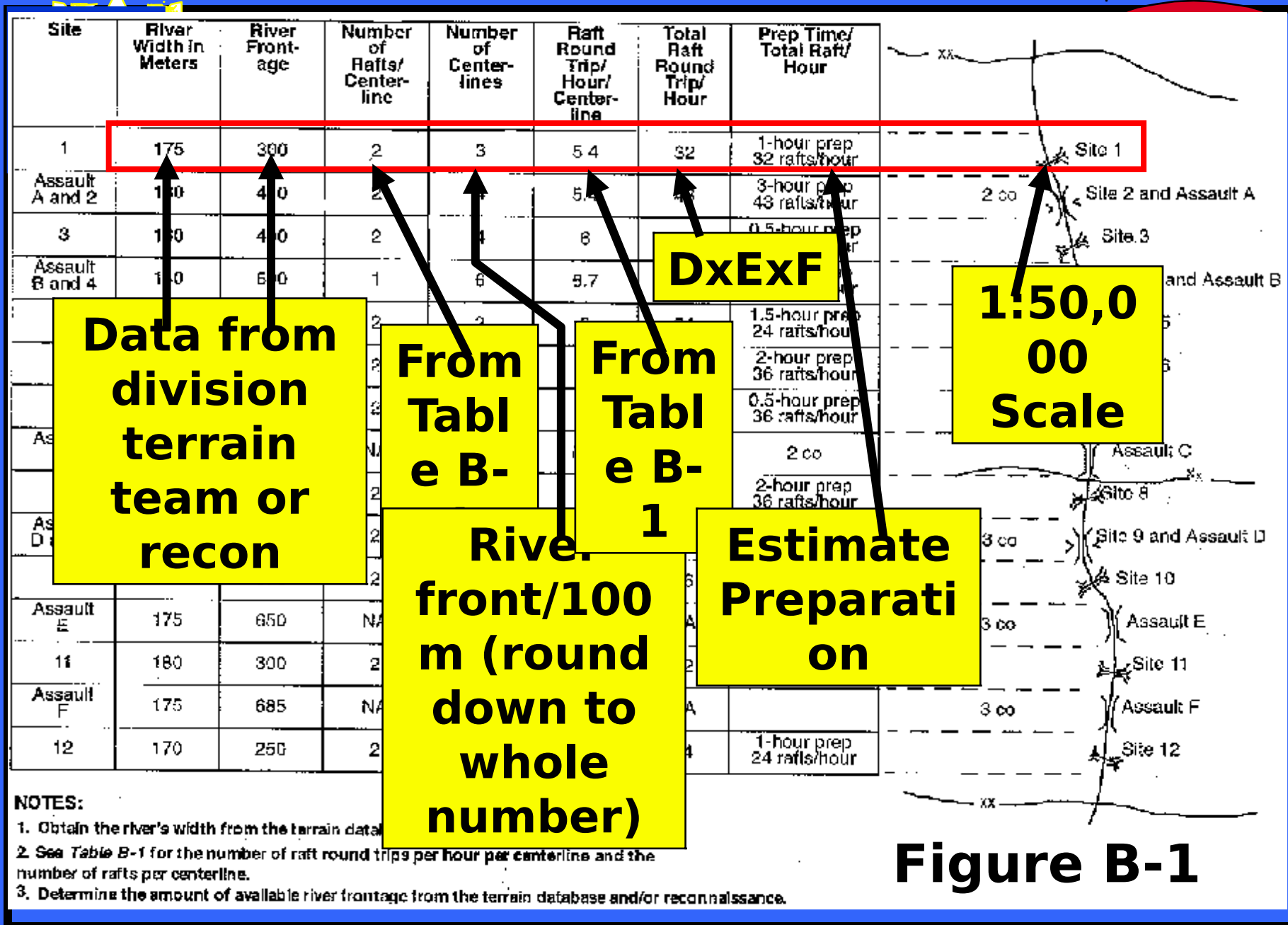
- **Mission Analysis:**
 - Review Division Site Overlay
 - Review Preliminary Crossing Timeline
- **SOEO Development:**
 - Crossing Overlay for each COA
 - Crossing Timeline for each COA
- **Finalize the Plan:**
 - Vehicle Crossing Capability Chart
 - Crossing Synchronization matrix
 - Engineer Execution Matrix

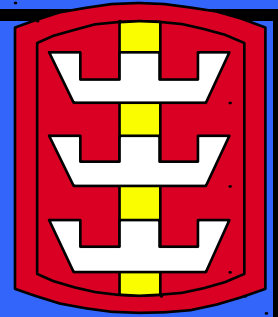


REVIEW DIVISION SITE OVERLAY

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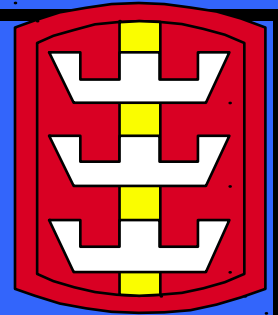




REVIEW DIVISION TIMELINE



FIGURE B-2. ROUGH DIVISION- CROSSING TIME LINE

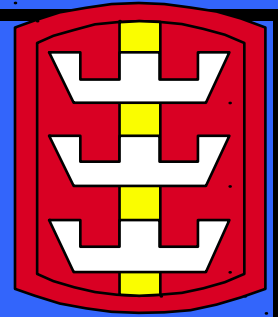


		H	H+1	H+2	H+3	H+4	H+5	H+6
1ST BDE					Mech Bn		FA Bn	
Site 1	32 raft/hr		Prep		(55 rafts)		(32 rafts)	
Site 3	48 raft/hr			Mech Bn		Engr Bn		
			Prep	(55 rafts)	(50 rafts)	Armd Bn		
2ND BDE				Prep		Mech Bn	FA Bn	
Site 8	36 raft/hr							
Site 9	72 raft/hr			Armd Bn	Mech Bn	Engr Bn		

Table B-3

Example uses 6-bay rafts.

Assumes pure BNs



PREPARE CROSSING OVERLAY FOR EACH COA

**FOR EACH CROSSING SITE USED IN THE
COA:**

**STAGING AREAS
HOLDING AREAS
CALL-FORWARD AREAS
ROUTES**

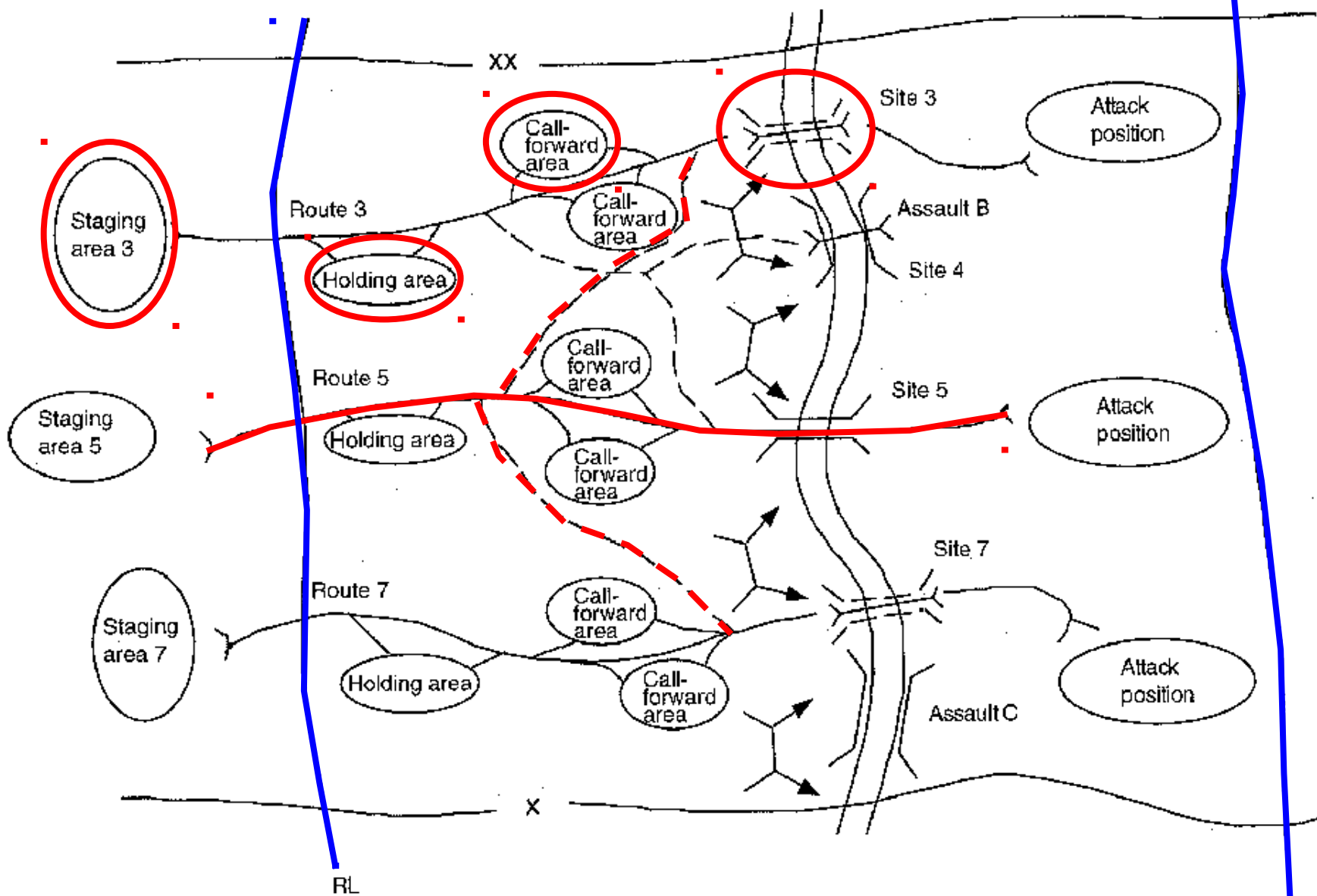
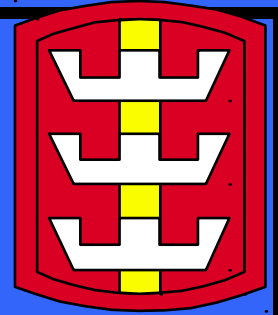


FIGURE B-3. COA CROSSING-AREA OVERLAY

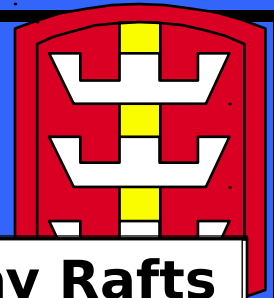


PREPARE BRIGADE CROSSING TIMELINE (FIGURE B4)

REQUIRE FROM S3:
TASK ORGANIZATION OF EA TF
CROSSING SITE ASSIGNMENT EA TF
ORDER OF CROSSING



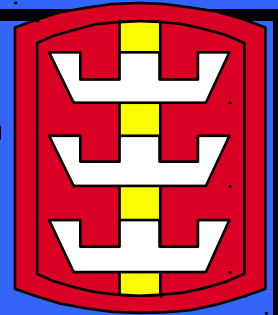
TABLE B-4. COMPANY RAFT REQUIREMENTS



Unit	Vehicles	6-Bay Rafts Required
Tank Company	15	14
Mechanized Company (Bradley)	15	7
Armored TF HQ	6	3
Mechanized TF HQs	6	3
Mortar Platoon	8	2
Scout Platoon	6	2
Engineer Platoon (+)	5	2
Division Cavalry Troop	24	16
Armored Cavalry Regiment Troop	27	17
Armored Cavalry Regiment Squad HQs	6	2
155-OSP Artillery Battery (Division)	18	9
ACR tank CO	15	14
FA Battery (ACR)	13	7



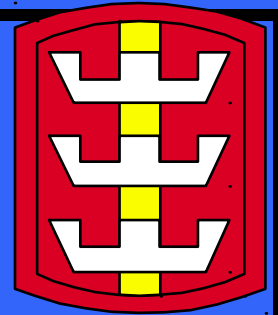
BRIGADE CROSSING TIME LINE FOR A COA



- Identify type of raft to use (4, 5, 6 bay) for site.
 - Based on vehicles and current velocity (Table C7)
- From Table B4
 - Calculate rafts required $[(\# \text{ rafts/unit type}) \times (\# \text{ of units})]$
- Calculate time for each subordinate TF to cross
 - $[(\text{rafts required}) / (\text{rafts/hr})] \times 60 \text{ min/hr}$
- Apply to Timeline



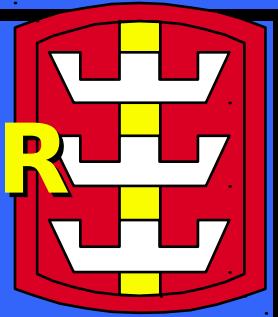
EXAMPLE



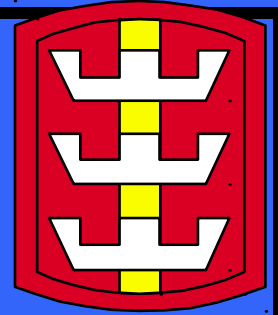
- **COA #1: TF 1 (2 x Tank CO, 2 x Mech CO) will raft from site 3.**
- **Current velocity = 2.7 MPS (assume 6 bay rafts)**
- **From Table B4**
 - 2 x Tank CO = 30 vehicles (28 x 6 bay rafts)
 - 2 x Mech CO = 30 vehicles (14 x 6 bay rafts)
 - 1 x Mortar Platoon = 8 vehicles (2 x 6 bay rafts)
 - TF HQ = 6 vehicles (3 x 6 bay rafts)
 - 2 x Engr Platoons = 10 vehicles (4 x 6 bay rafts)
- **Total Raft requirement at Site 3 = 53 rafts**
- **Site capacity (from Div Site Overlay) = 48 rafts/hour**
- **Time required = $53/48 = 1.1$ hours**



FIGURE B-4. BRIGADE CROSSING TIME LINE FOR A COA



Assault A	H	H+1	H+2	H+3	H+4	H+5	H+6	H+7
Site 1	Not Used							
Site 2	Not Used							
Site 3		Prep	Mech TF-1		Engr Bn			
Assault B								
Site 4		Prep	Alternate Site					
Site 5		Prep	Armd TF-1	Armd TF-2	FA			
Site 6	Not Used							
Site 7		Prep	Mech TF-2		ADA			
Assault C	TF-2							



PREPARE VEHICLE CROSSING CAPABILITY CHART (FIGURE B5)

**Determine crossing capability each site
(Day/Night)**

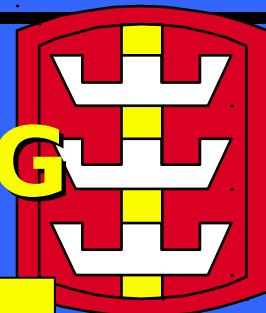
Determine Crossing Requirements (B4)

Block Out Crossing Period

Coordinate with S3



FIGURE B-5. INITIAL VEHICLE CROSSING CAPABILITY

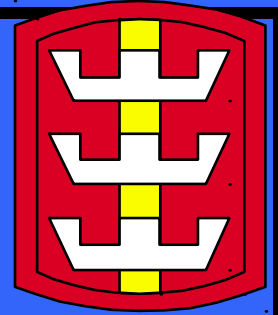


4 centerlines x 2 rafts/centerline

Div site overlay*. 50% at night

Site	Crossing Means	Trips/Hour		Beginning Morning Nautical					
		Day	Night	H	H+1	H+2	H+3	H+4	H+5
3	8 six-bay ribbon rafts; convert to bridge	40	26	Mech TF-1		Bn H		Follow-on Forces	
				Site prep & const		26 rafts		Const bridg	
7	6 six-bay ribbon rafts; convert to bridge	36	24	Armd TF-1		FA Bn		Field Trains	
				35 veh		200 veh		Bridge 200 vehicles/hour	
7	6 six-bay ribbon rafts; convert to bridge	36	24	Mech TF-2		Follow-on Forces			
				Site prep & const		24 rafts		Const bridg	

Calculate capacity during night/day

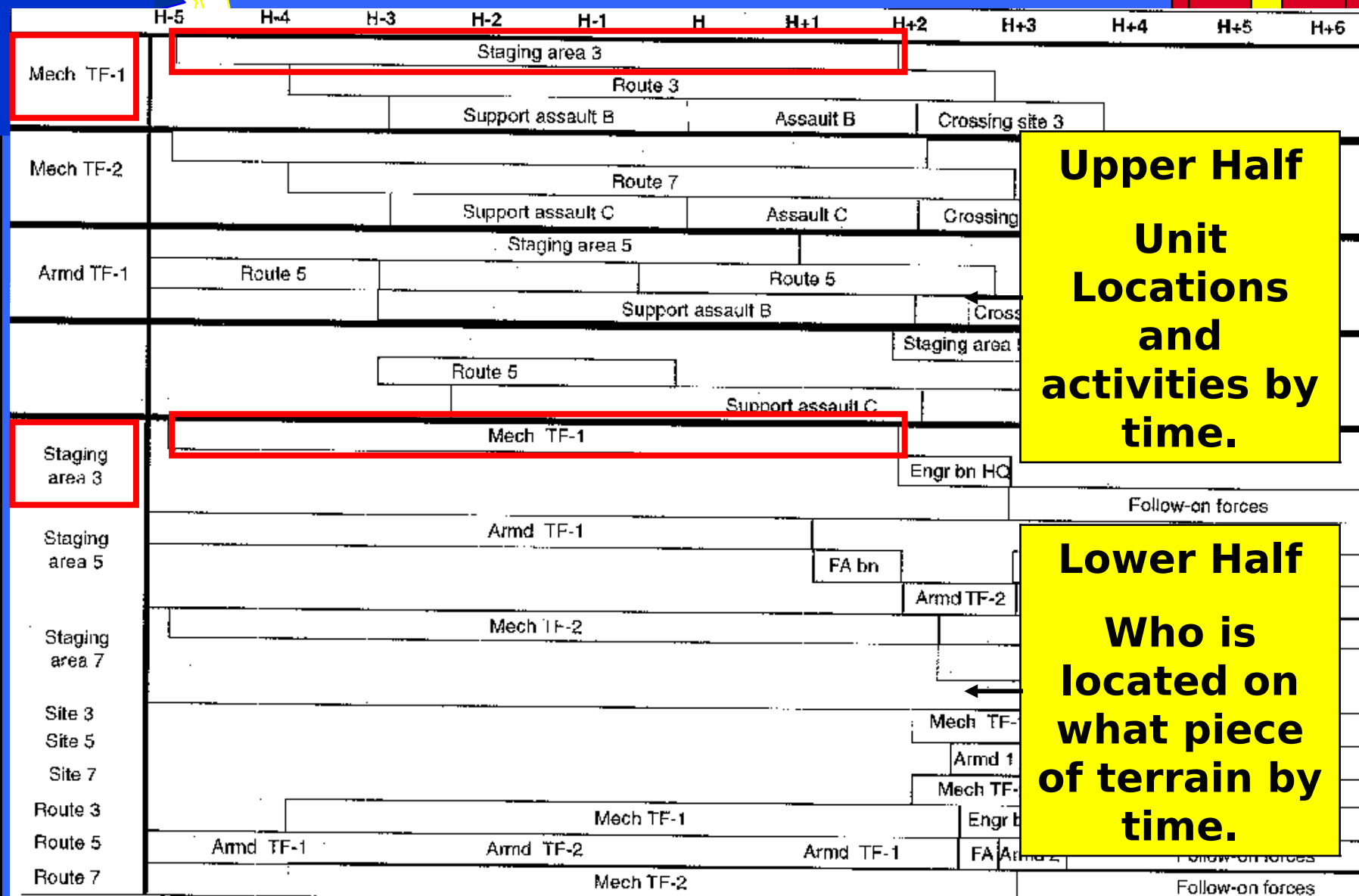


DEVELOP CROSSING SYNCHRONIZATION MATRIX (FIGURE B7)

BY UNIT:

**PORTRAY UNIT CROSSING TIMES
ADD UNIT ROAD MOVEMENT TIMES
ADD UNIT STAGING-AREA TIMES
REPEAT BY TERRAIN LOCATION**

B-7. CROSSING-SYNCHRONIZATION MATRIX

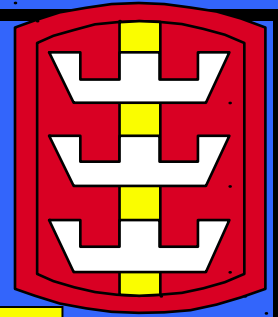


Upper Half
Unit
Locations
and
activities by
time.

Lower Half
Who is
located on
what piece
of terrain by
time.



SYNCHRONIZATION MATRIX

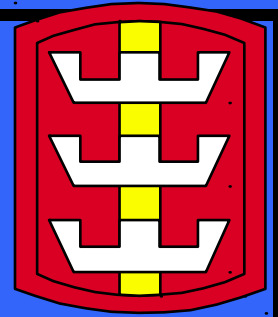


Assault B

Support Assault B

Dismounts move to CO attack position
Vehicles move to CO SBF positions
Assault Companies arrive at dismount p
Boat offload and preparation
Far Shore preparation
DS Engineer Platoon arrives on site

Engineer far shore technical reconnaissance



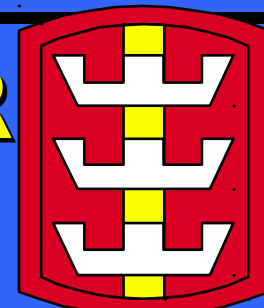
PREPARE ENGINEER EXECUTION MATRIX

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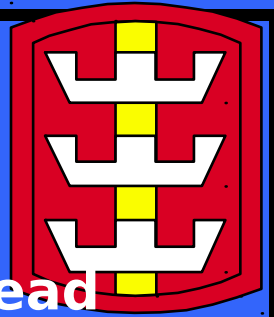
FIGURE B-8. ENGINEER EXECUTION MATRIX



	H-3	H-2	H-2	H	H+1	H+2	H+3	H+4	H+5
A/237	Move to site B. Move to site 3.	Prep RB15s. Establish ERPs.	Execute assault-boat operations; assault site B.		Prepare site 3.	Perform route maintenance of route 3. Operate crossing site 3.			
B/237	Move to assault site C.	Position and prepare boats.	Execute assault-boat operations assault site C.			Perform route maintenance of route 7.			
C/237		Move to site 7.	Establish ERPs.		Prepare site 7.	Operate crossing site 7.			
D/237		Move to site 5.	Establish ERPs.		Prepare site 5.	Perform route maintenance of route 5. Operate crossing site 5.			
203 AFB co	Deliver assault rafts.		Move to equipment park 3.		Build rafts, site 3.	Operate rafting site 3.		Construct bridge, site 3.	
204 AFB co	Deliver assault rafts.		Move to equipment park 5.		Construct bridge, site 5.		Operate bridge site 5.		
205 AFB co	Deliver assault rafts.		Move to equipment park 7.		Build rafts, site 7.	Operate rafting site 7.		Construct bridge, site 7.	



ENGINEER EXECUTION MATRIX



Div Engineer Battalion Are part of the Bde Bridgehead Force

A CO

Missions

B CO

M/S missions on far bank

C CO

Engineer Group Are part of the Brigade Maneuver Sp Force

Missions

237 EN BN (Corps)

Recon

203 EN CO (AFB)

Aslt Boat Operations

204 EN CO (AFB)

Route Marking/Maintenance

205 EN CO (AFB)

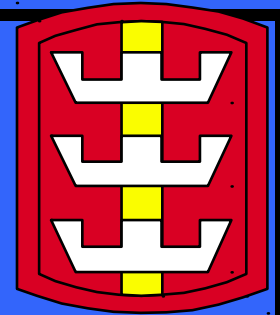
Raft/Br Ops

ERPs

Boat Tpt



TABLE C-6. ALLOCATION OF RIBBON BRIDGE (L-SERIES TOE)

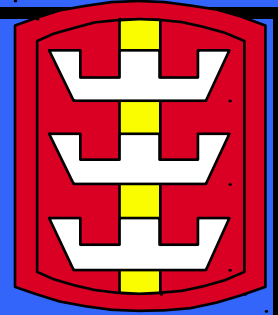


Components	Per Corps Ribbon Company
Bridge platoons	2
Interior bays	30
Ramp bays	12
BEBs	15

NOTE: The longest bridge that can be constructed is 215 meters (705 feet).



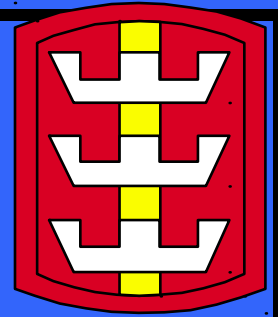
TABLE C-11. NUMBER OF BOATS NEEDED FOR ANCHORAGE OF RIBBON BRIDGE



Current Velocity (MPS/FPS)	Number of Boats	Number of Bridge Bays
0 - 2.0/0 - 6.5	1 : 6	
2.0 - 2.6/6.5 - 8.5	1 : 3	
2.7/9	1 : 2	
Over 2.7/Over 9	Bridge must be anchored using an overhead cable system	
Anchorage of ribbon bridges is normally accomplished by tying BEB's to the downstream side of the bridge.		



TASK ORGANIZATION



203 EN CO (AFB) 204 EN CO (AFB) 205 EN CO (AFB)

Site 3 -8x 6Bay raftSite 5 -150M BridgSite 6 -6 x 6 bay rafts

Calculate Resource Requirements at each site:

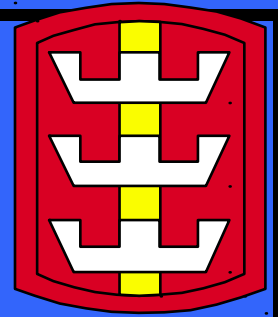
Interior Bay:

Ramp bay:

BEB:



SUMMARY

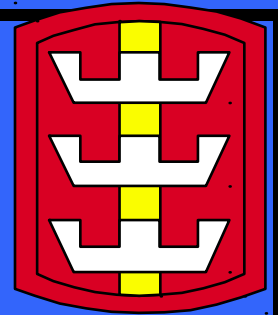


- Categories.
- Fundamentals.
- Command and Control
- Engineer Planning



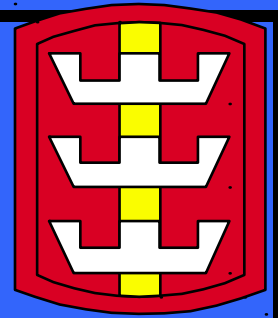


GENERAL PLANNING NOTES:



- **MOBILITY/SURVIVABILITY:**

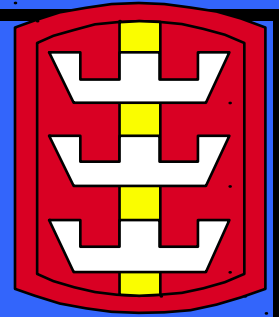
- Commanders and staffs do not plan or synchronize river crossing operations
- Staffs do not identify, and units do not set, the conditions to conduct river crossing
- Commanders and primary staff officers tend to view river crossing as an engineer operation, instead of as a complex combined arms operation
- Units assign river crossing operations to subordinate units and do not provide required support



Question?

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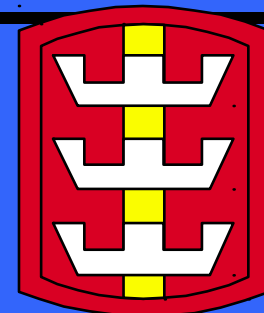
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PE “Walk Through”



RIVER CROSSING “WALK THROUGH” PRACTICAL EXERCISE

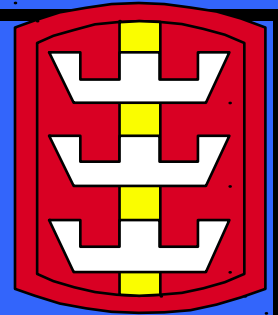


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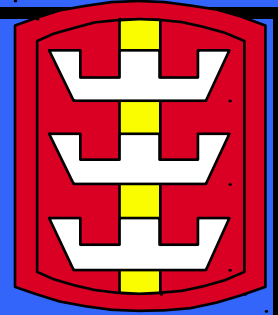
P.E. OBJECTIVE



- **ACTION:** Students will calculate the necessary assets for a Brigade River Crossing.
- **CONDITION:** Given a previous River Crossing block of instruction, FM 90-13, a COA, use of calculators and group assistance,
- **STANDARD:** Students will calculate a Brigade crossing time line and a vehicle crossing capability chart for a stated COA.



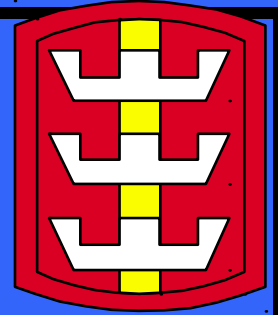
GENERAL PLANNING STEPS



- 1. Gather appropriate data/IPB.**
- 2. Review Maneuver's Plan/EBA.**
- 3. Develop an SOEO to support each COA.**
- 4. Wargame and refine each COA.**
- 5. Finalize the plan.**



GENERAL PLANNING STEPS



1. Gather appropriate data.

- Division's OPORD.**
- DIVENG Annex.**
- Division's-site overlay.**
- Division crossing time line.**
- Division's crossing area overlay.**
- Additional weather and terrain data.**
- MTOEs of BDE units and attachments.**
- MTOE of bridging assests.**
- FM 90-13.**

Site	River Width in Meters	River Frontage <i>(From recon or Division team)</i>	Number of Rafts/Center-line	Number of Center-lines <i>(100m apart)</i>	Raft Round Trip/Hour/Center-line	Total Raft Round Trip/Hour	Prep Time/ Total Raft/Hour	
	175	300	2	3	5.4	32	1-hour prep 32 rafts/hour	Site 1
Assault A and 2	180	410	2	4	5		3-hour prep 43 rafts/hour	Site 2 and Assault A
3	165						0.5	Site 3
Assault B and 4	140							Site 4 and Assault B
5								
6								
7	165	300	2	3	6	36	0.5-hour prep 36 rafts/hour	Site 7
Assault C	150	400	NA	NA	NA	NA	2 co	Assault C
8	150	350	2	3	6	36	2-hour prep 36 rafts/hour	Site 8
Assault D and 9	160	610	2	6	6	72	0-hour prep 72 rafts/hour	Site 9 and Assault D
10	170	375	2	3	6	36	0-hour prep 36 rafts/hour	Site 10
Assault E	175	650	NA	NA	NA	NA		Assault E
11	180	300	2	3	5.4	32	1-hour prep 32 rafts/hour	Site 11
Assault F	175	685	NA	NA	NA	NA		Assault F
12	170	250	2	2	6	24	1-hour prep 24 rafts/hour	Site 12

NOTES:

1. Obtain the river's width from the terrain database and/or reconnaissance.
2. See Table B-1 for the number of raft round trips per hour per centerline and the number of rafts per centerline.
3. Determine the amount of available river frontage from the terrain database and/or reconnaissance.

Figure B-1. Division-site overlay

Table B-1. Raft-centerline data

River Width in Meters	Round Trip in Minutes	Number of Raft Trips per Hour	Number of Rafts
75	7	8.6	1
100	8	7.5	1
125	9	6.7	1
150	10	6.0	2
175	11	5.4	2
225	12	5.0	2
300	16	3.75	3 to 5

NOTE: Planning times are for current velocities up to 1.5 MPS

Table B-2. Boat-planning factors

Equipment	Characteristic	River Width		
		75 Meters	150 Meters	300 Meters
Pneumatic assault boat with an OBM	Minutes per round trip	3	4	5
	Trips per hour	20	15	12
Pneumatic assault boat without an OBM	Minutes per round trip	4	6	10
	Trips per hour	15	10	6

NOTES:

1. Factors are averaged based on load/unload time and safety.
2. Planning times are for current velocities up to 1.5 MPS. For faster current velocities, classification must be reduced to a caution or risk crossing, and an engineer analysis must be made of the actual site conditions before planning times may be assessed.

Table B-3. Unit rafting requirements

Units	Vehicles	Raft Trips Required		
		4 Bays	5 Bays	6 Bays
Armored battalion	161	119	101	86
Mechanized battalion	153	112	65	55
FA battalion	165	97	61	52
Engineer battalion (ERI)	139	77	59	50
ACR	208	171	110	98

NOTE: Assume that current velocities are less than 0.9 MPS and that battalions/regiments are at 100 percent MTOE strength.

F M 90-13 Appendix B



- Table B-1 Raft-centerline data based on river width.

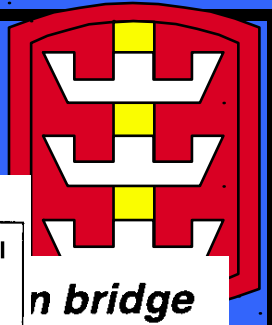
- Table B-2 Boat-planning factors.

- Trip times based on width.

- Rafting bay requirements vs. unit type.



FM 90-13 Appendix C



current velocities greater than 1.2 MFS (2 fps).

*Three BEBs are required for conventional rafting of 1', 2' or 6 day rafts in 1'. The assembly time for a raft increases by 20 percent at night.

6. Each raft requires a minimum of two BEBs for propulsion.

2. Vehicles should only be loaded on the interior bays.

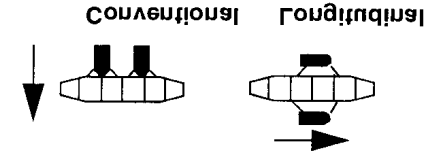
4. The draft of a fully loaded ribbon raft is 61 centimeters (24 inches).

3. The roadway width of a ribbon raft is 4.1 meters (13 feet 2 inches). must be used.

5. If the current's velocity in the loading/unloading area is greater than 1.2 MFS (2 fps), then conventional rafting

1. When determining raft classification, L refers to the longitudinal rafting and C refers to conventional rafting.

NOTES:

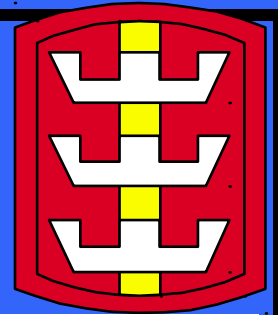


tracked wheeled & interiors) (5 ramps) 6 bays	50	(88) 56.8	C L	10 80 80 80 80 80	12 80 80 80 80 80	10 80 80 80 80 80	10 80 80 80 80 80	10 80 80 80 80 80	22 22 10 80 80 80	30 30 10 80 80 80	0 10 10 80 80 80
3 interiors) (5 ramps) 2 bays	12	(66) 50.1	C L	12 12 12 12 12 12	10 12 12 12 12 12	10 12 12 12 12 12	10* 10 10 10 10 10	20* 10 10 10 10 10	52* 80 80 80 80 80	0 80 80 80 80 80	
5 interiors) (5 ramps) 4 bays	15	(44) 13	C L	80 10 10 10 10 10	80 10 10 10 10 10	80 10 10 10 10 10	22* 80 80 80 80 80	40* 80 80 80 80 80	30* 80 80 80 80 80	12* 22 22 22 22 22	0 42 42 42 42 42
1 interior) (5 ramps) 3 bays	8	(55) 8.1	C L	42 42 42 42 42 42	42 42 42 42 42 42	32 42 42 42 42 42	52 40 40 40 40 40	12 40 40 40 40 40	10 32 32 32 32 32	0 30 30 30 30 30	0 52 52 52 52 52
Types Raft	Minutes Time in Assembly	Meters in Space Load (feet)	Classi- fication	(0-3) 0-0.0	(4) 2.1	(2) 2.1	(6) 2.1	(1) 5	(8) 5.2	(9) 5.1	(10) 3
				Current Velocity in MFS (fps) and MLC							

Table C-1. Ribbon-raft design



ROUGH DIVISION CTL



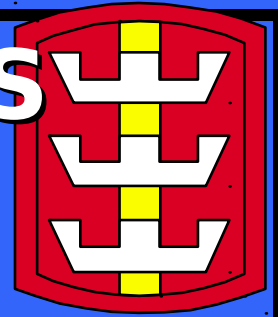
		H	H+1	H+2	H+3	H+4	H+5	H+6	H+7	H+8
1st brigade										
Site 1	32 raft/hour		Prep	Armd bn (86 rafts)			FA bn (32 rafts)			
Site 3	48 raft/hour		Prep	Mech bn (55 rafts)	Engr bn (50 rafts)	Armd bn				
2nd brigade										
Site 8	36 rafts/hour		Prep			Mech bn	FA bn			
Site 9	72 rafts/hour		Armd bn	Mech bn	Engr bn					

Figure B-2. Rough division-crossing time line



GENERAL PLANNING STEPS

(Cont'd)



2. Review Maneuver's Plan/Conduct EBA.

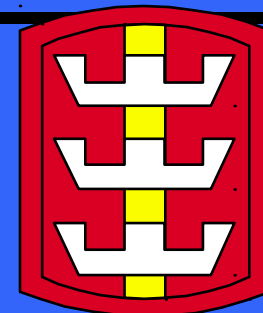
- **Mission/Cdr's intent.**
- **Determine requirements/resources needed.**
- **Time available.**
- **Conduct EBA.**
 - **Know terrain and impacts of weather.**
 - **Know river characteristics.**
 - **Know EN M/S.**
 - **Know friendly capabilities.**
 - **Apply rules of thumb.**
- **Extract Develop an initial Bde crossing timeline.**

***Table C-6. Allocation of ribbon bridge
(L-series TOE)***

Components	Per Corps Ribbon Company
Bridge platoons	2
Interior bays	30
Ramp bays	12
BEBs	15

NOTE: The longest bridge that can be constructed is 215 meters (705 feet).

**For an organic
AFB Company**



		3' 225 kg. The post weighs medium-weight one medium-weight with a cradle or for bridge truck ried by one 2- The post is car-	equipment: 1' 225 kg of equipment of soldiers with crew and 15 carry a 3-man The post can		cradle: is much from the • 155 cm for a loaded • 66 cm when fully operations: • 26 cm for normal The draft is—
BEB-2D	upon bridge co- vides 14 bel corps L-series TOE pro-			is 2 minutes from the cradle launch time	
ABC M113	end co (EBI): • 2 bel armored (wech) (M113). • 3 bel int co (wech) (BIEV). • 1 bel int co end pu. • 15 bel end co of vides— L-series TOE pro-	vehicle: • is a Class 13 propelled. • is self- The APC—	equipment: dies with carry 15 sol- The APC can	feet): meters (2 ford up to 1.2 The APC can MB2 (2'3 lbs). speed is 1.6 swimming the water: propelled in back- The APC is minutes: wind is 10 time for swim- Preparation	$\frac{1.6}{\text{current}} \times (\text{meters})$ (feet width) Diff (meters) = MB2 (2 lbs). rent velocity is 1.2 The maximum cur-
	pon bridge co- • 18 bel corps up- bridge co- • 15 bel corp most bridge co- • 18 bel corps end co- • 3 bel combat vides— L-series TOE pro-	weigh 26 kg. The post and carry: back (1-man ried by back- The post is car-	equipment: 306 kg of equipment of dies with carry 3 sol- The post can		OBN: used without an The post cannot be
source post reconnais- 3-man Pneumatic.	• 15 bel corp most bridge co- • 18 bel corps end co- • 3 bel combat vides— L-series TOE pro-			is 1.0 MB2 (3 Baddle speed a pump. 2 minutes with inflation time is	dies are required bet- One pump and 3 bad- MB2 (2 lbs). rent velocity is 1.2 The maximum cur-
post assault 12-man Pneumatic.	• 51 bel MS co- • 51 bel MGB co- post team. • 80 bel assault- co- upon bridge • 51 bel corps end co- • 2 bel sep pde most bridge co- • 51 bel corps bridge co- • 18 bel upon vides— L-series TOE pro-	weighs 135 kg. A deflated post men. can carry 8 An inflated post deflated posts. can carry 50 A 5 115-ton truck	ment: kg of equip- OBN or 1' 231 endies with an soldiers and 5 baddies or 15 endies with dies and 3 carry 15 sol- The post can	MB2 (12 lbs). OBN is 4.2 Speed with an lbs). is 1.2 MB2 (2 Baddle speed pumps: utes with 2 to 10 min- inflation time is	requested separately. OBMs must be with each post. baddies are included Three pumps and 11 slope is desired. A 50 percent exit lbs). dies is 1.2 MB2 (2 rent velocity with bad- The maximum cur-
Equipment	Allocation	Transportation	Capabilities	Preposition Assembly	Limitations Remarks

Table C-1. Equipment-characteristic chart

Table B-1. Raft-centerline data

River Width in Meters	Round Trip in Minutes	Number of Raft Trips per Hour	Number of Rafts
75	7	8.6	1
100	8	7.5	1
125	9	6.7	1
150	10	6.0	2
175	11	5.4	2
225	12	5.0	2
300	16	3.75	3 to 5

NOTE: Planning times are for current velocities up to 1.5 MPS

Table B-2. Boat-planning factors

Equipment	Characteristic	River Width		
		75 Meters	150 Meters	300 Meters
Pneumatic assault boat with an OBM	Minutes per round trip	3	4	5
	Trips per hour	20	15	12
Pneumatic assault boat without an OBM	Minutes per round trip	4	6	10
	Trips per hour	15	10	6

NOTES:

1. Factors are averaged based on load/unload time and safety.
2. Planning times are for current velocities up to 1.5 MPS. For faster current velocities, classification must be reduced to a caution or risk crossing, and an engineer analysis must be made of the actual site conditions before planning times may be assessed.

Table B-3. Unit rafting requirements

Units	Vehicles	Raft Trips Required		
		4 Bays	5 Bays	6 Bays
Armored battalion	161	119	101	86
Mechanized battalion	153	112	65	55
FA battalion	165	97	61	52
Engineer battalion (ERI)	139	77	59	50
ACR	208	171	110	98

NOTE: Assume that current velocities are less than 0.9 MPS and that battalions/regiments are at 100 percent MTOE strength.



- Centerlines >100m apart!
- Assault Companies need 200

- Bde "IBRB" Crossing:
 - 70 boats for 2 Bns.
 - 31 boats for 1 Bn w/3. Companies in 1st wave.

- Bde needs 2 bridges or the equivalent bridging configured into rafts.

		H	H+1	H+2	H+3	H+4	H+5	H+6	H+7	H+8
1st brigade	Site 1	32 raft/hour		Prep	Armd bn (86 rafts)		FA bn (32 rafts)			
	Site 3	48 raft/hour	Est 1 HR	Prep	Mech bn (55 rafts)	Engr bn (50 rafts)	Armd bn			
2nd brigade	Site 8	36 rafts/hour		Prep		Mech bn	FA bn			
	Site 9	72 rafts/hour		Armd bn	Mech bn	Engr bn				

B-2. Rough division-crossing time line

Determine Assault boat requirements and time for Mech Bn at Assault A, (Spting attack BDF)

Rule of Thumb: "31RB - 15s for 3

With 12 Inf, 2 Corps Engr

Total of 31 X 12 = 372 dismounts per wave

No OBM, at a rate of (Table B - 2) 5 minutes per round trip (at 180 M wide), Crossing time > 15 minutes for whole BN. Plus Assault of FarShore Objective. (approx 45 minutes)

		H	H+1	H+2	H+3	H+4	H+5	H+6
1st brigade								
Site 1	32 raft/hour		Prep	Armd bn (86 rafts)		FA bn (32 rafts)		
Site 3	48 raft/hour		Prep	Mech bn (55 rafts)	Engr bn (50 rafts)	Armd bn		
2nd brigade								
Site 8	36 rafts/hour		Prep		Mech bn	FA bn		
Site 9	72 rafts/hour		Armd bn	Mech bn	Engr bn			

**Example using
6-bay rafts**

**How many rafts
and how long will
it take to cross
the Armd bn?**

Figure B-2. Rough division-crossing time line

		H	H+1	H+2	H+3	H+4	H+5	H+6	H+7	H+8
1st brigade				Prep	Armd bn (86 rafts)		FA bn (32 rafts)			
Site 1	32 raft/hour									
Site 3	48 raft/hour		Prep	Mech bn (55 rafts)	Engr bn (50 rafts)	Armd bn	H + 5 1/2			
2nd brigade			Prep		Mech bn		FA bn			
Site 8	36 rafts/hour									
Site 9	72 rafts/hour		Armd bn	Mech bn	Engr bn					

Figure B-2. Rough division-crossing time line

According to Table B-3 p. B- 5 FM 90-13

Table B-3. Unit rafting requirements				
Units	Vehicles	Raft Trips Required		
		4 Bays	5 Bays	6 Bays
Armored battalion	161	119	101	86
Mechanized battalion	153	112	65	55
FA battalion	165	97	61	52
Engineer battalion (ERI)	139	77	59	50
ACR	208	171	110	98

NOTE: Assume that current velocities are less than 0.9 MPS and that battalions/regiments are at 100 percent MTOE strength.

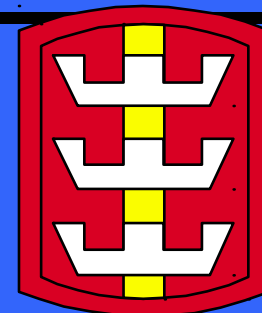
It indicates that the Armored BN with 161 vehicles will require 86 6-Bay rafts

So

$\frac{86 \text{ rafts}}{48 \text{ rafts/hr}} = 1.75 \text{ hrs, requiring 86 6-Bay rafts}$

Table B - 4 Pure company rafting requirements

Units	Vehicles	Rafts Required		
		4 Bays	5 Bays	6 Bays
Tank Company	15	15	14	14
Mechanized company	15	14	7	7
Armored TF HQ	6	4	4	3
Mechanized TF HQ	6	4	4	3
Mortar Platoon	8	3	2	2
Scout Platoon	6	3	2	2
Engineer Platoon	5	3	2	2
Division cavalry troop	24	23	16	16
ACR troop	27	25	18	17
ACR squadron HQ	6	4	3	2
155-SP artillery battery (division)	18	16	9	9
ACR tank co	15	15	14	14
FA battery (ACR)	13	13	10	7



**So, for our Armored BN:
4 Cos at 14 (6 bay) Rafts
1 FA BTY at 7**

**1 BN CO at 17* (table B-3 says
BN = 50)**

**1 Mortar Plt at 2
1 Scout Plt at 2
1 AR TF HQ at 2**

86 rafts

**At 48 rafts/hr,
roughly
1hr 50 mins, if at
night
add 50% (55 mins)
therefore 2 hrs 45
mins to cross the
entire BN by rafts.
But also consider
BDE
may have already
massed CBT PWR and
taken "Exit Bank
Oh!"**

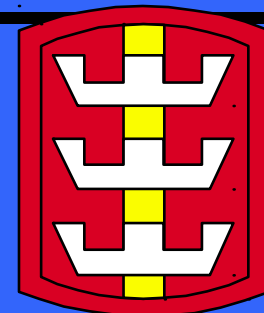
14 FEBRUARY

	H	H + 1	H + 2	H + 3	H + 4	H + 5	H + 6	H + 7	H + 8	H + 9	H + 10
Site 1	Not used										
Site 2	Not used										
Site 3		Prep	Mech TF-1			Engr bn					
Assault B	TF-1										
Site 4		Prep		Alternate site							
Site 5		Prep	Armd TF-1	Armd TF-2	FA						
Site 6	Not used										
Site 7		Prep	Mech TF-2			ADA					
Assault C	TF-2										

Figure B-4. Brigade-crossing time line for a COA



GENERAL PLANNING STEPS

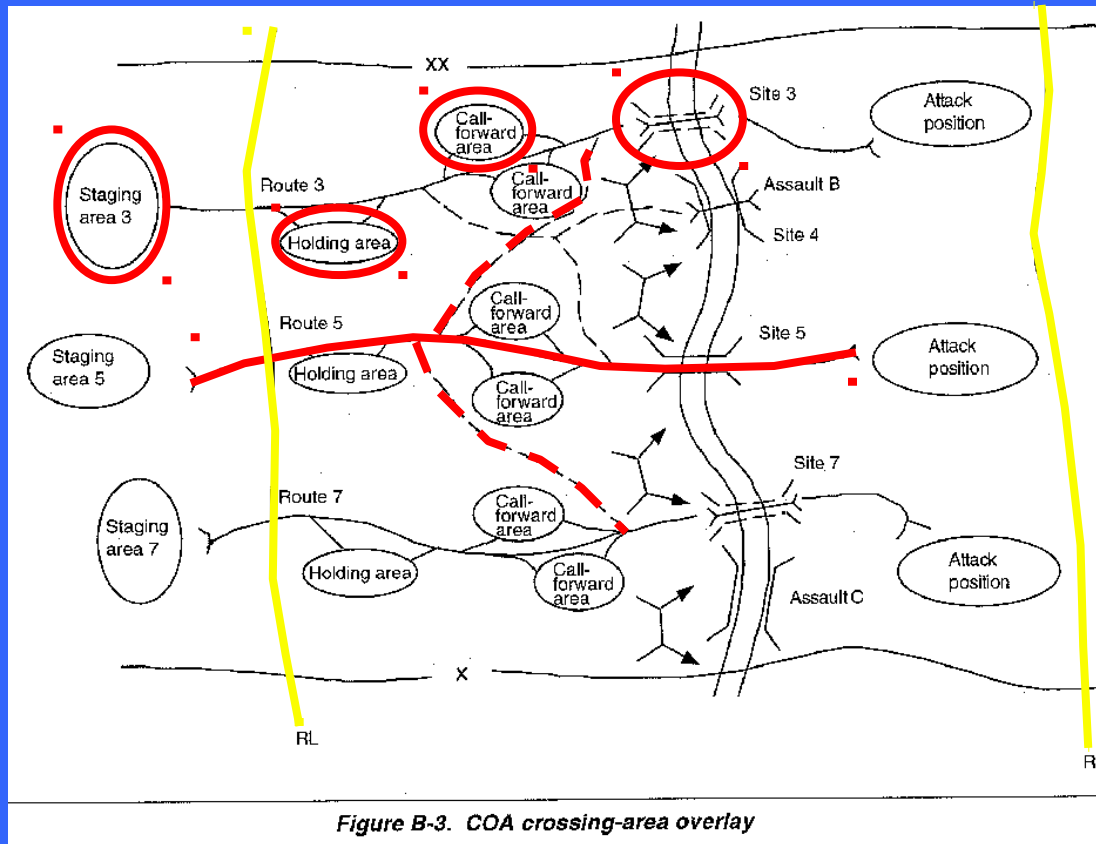
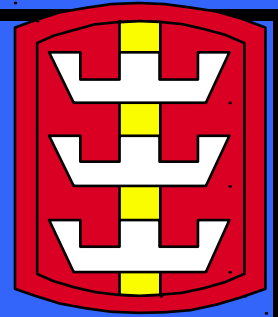


3. Develop SOEOs to support each COA

- Take our BDE crossing timeline and increase the details
 - Make sketches of sites and TF SOM.
 - Apply crossing rates for night.
 - Expand the crossing timeline per crossing unit and type. (Think two levels down, i.e. company).
 - Develop initial vehicle crossing capability matrix.
- Consider your SOEO, how many phases must you address as a minimum?



CROSSING - AREA OVERLAY PER COA





- Identify type of raft to use (4, 5, 6 bay) for site.
- Calculate rafts required:
 $(\# \text{ rafts/unit type}) \times (\# \text{ of units}) = \text{company rafting requirements}$
- Calculate time:
 $[(\text{rafts required})/(\text{rafts/hr})] \times 60 \text{ min/hr} = \text{time}$

Example:

- Mech TF-1 (3 x IN and 1 x AR) crossing at Site 3 (48 rafts/hr)
- Go to table B-4
- $(3 \times 7) + (1 \times 14) = 35 \text{ rafts required}$
- $[(35 \text{ rafts required}) / (48 \text{ rafts/hr})] \times 60 \text{ min/hr} = 44 \text{ min}$

Site 2	Not used									
Site 3	Prep	Mech TF-1				Engr bn				
Assault B	TF-1									
Site 4	Prep				Alternate site					
Site 5	Prep	Armd TF-1		Armd TF-2		FA				
Site 6	Not used									
Site 7	Prep	Mech TF-2				ADA				
Assault C	TF-2									

At t
plan

**At the Bde
planning level**

Figure B-4. Brigade-crossing time line for a COA



current velocities greater than 1.2 MFS (2 fps).

Three BEBs are required for conventional rafting of 4', 5' or 6 pay rafts in 1'.

The assembly time for a raft increases by 20 percent at night.

Each raft requires a minimum of two BEBs for propulsion.

Vehicles should only be loaded on the interior pays.

The draft of a fully loaded ribbon raft is 61 centimeters (24 inches).

The roadway width of a ribbon raft is 4.1 meters (13 feet 2 inches).

must be used.

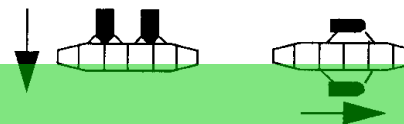
If the current's velocity in the longitudinal loading area is greater than 1.2 MFS (2 fps), then conventional rafting

When determining raft classification, L refers to the longitudinal rafting and C refers to conventional rafting.

NOTES:


Conventional

Longitudinal



Tracked wheeled & interiors) (5 ramps) e pays	50	(88) 50.8	C	10 20 30 40	12 20 30 40	10 20 30 40	10 20 30 40	10 20 30 40	22 30 40 50	30 40 50 60	0 10 20 30
3 interiors) (5 ramps) 2 pays	12	(66) 50.1	C	12 12 12 12	10 12 12 12	10 12 12 12	10 12 12 12	10 12 12 12	20 30 40 50	30 40 50 60	0 10 20 30
5 interiors) (5 ramps) 4 pays	15	(44) 13	C	20 10 10 10	20 10 10 10	20 10 10 10	20 10 10 10	20 10 10 10	40 50 60 70	50 60 70 80	0 10 20 30
1 interior) (5 ramps) 3 pays	8	(55) 12.1	C	42 42 42 42	42 42 42 42	32 42 42 42	52 40 40 40	12 40 40 40	10 32 32 32	0 30 30 30	0 52 52 52
Types Raft	Minutes Time in Assembly	(feet) Meters in Space Load	Classi- fication	(0-3) 0-0.8	(4) 1.1	(2) 1.2	(6) 1.6	(1) 1	(8) 1.2	(a) 1.5	(10) 3
Current Velocity in MFS (fps) and MLC											

Table C-1. Ribbon-raft design



Site	Crossing Means	Trips/Hour		Beginning Morning Nautical Twilight						
		Day	Night	H	H + 1	H + 2	H + 3	H + 4	H + 5	H + 6
3	8 six-bay ribbon rafts; convert to bridge	40	26		Site prep & const	26 rafts	40 rafts	Const bridge	Bridge	
5	Bridge	200	200							
		Vehicles/hour						200 vehicles	Bridge 200 vehicles/hour	
7	6 six-bay ribbon rafts; convert to bridge	36	24							
								rafts	Const bridge	Bridge

Figure B-5. Initial veh

**Add 50% for
night reference
Tables C-7/8**

Site crossing capability matrix

**Figure C-6 states for
bridging**

**# of Interior = Gap
(meters)-14
bays 6.7**

=Gap (feet)-

45

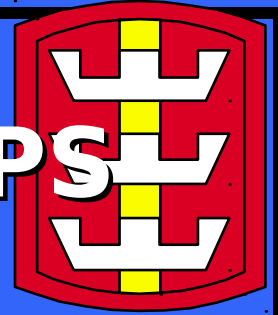
22

**Site 5 is 150m wide, how
long will it take to erect at night
and how many bays will it
take to build?**

**150-14 = 136/6.7 = 23 interior bays
and 133 M at night, roughly 1hr 7 min**

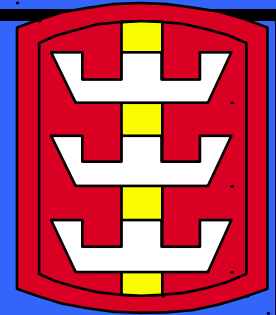


GENERAL PLANNING STEPS



4. Wargame and refine each COA.

-Take our BDE initial vehicle crossing capability matrix and develop the final vehicle crossing capability matrix adjusting it to fit any changes to it by wargamming.



Site	Crossing Means	Trips/Hour		Beginning Morning Nautical Twilight							
		Day	Night	H	H + 1	H + 2	H + 3	H + 4	H + 5	H + 6	
3	8 six-bay ribbon rafts; convert to bridge	40	26			Mech TF-1		Engr bn HQ		Follow-on forces	
				Site prep & const		26 rafts		40 rafts		Const bridge	Bridge
5	Bridge	200	200			Armd TF-1	FA bn	Armd TF-2	Field trains		
		Vehicles/hour		Site prep/const bridge		85 veh	200 vehicles		Bridge 200 vehicles/hour		
7	6 six-bay ribbon rafts; convert to bridge	36	24			Mech TF-2				Follow-on forces	
				Site prep & const		24 rafts				Const	

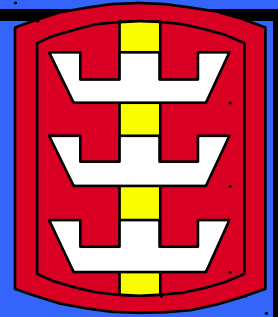
Apply unit times to site c

Figure B-6. Final vehicle-crossing capability

Apply unit times to site crossing capability matrix.



GENERAL PLANNING STEPS



5. Decide and finalize the plan.

- Based on the ginal vehicle crossing capability matrix, generate a vrossing synchronization matrix and an engineer execution matrix.
- Check task organization for establishments of ERPs, RB15, CFAs, and AFB Co.s.
- Double check all calculations.
- Publish order and annex.

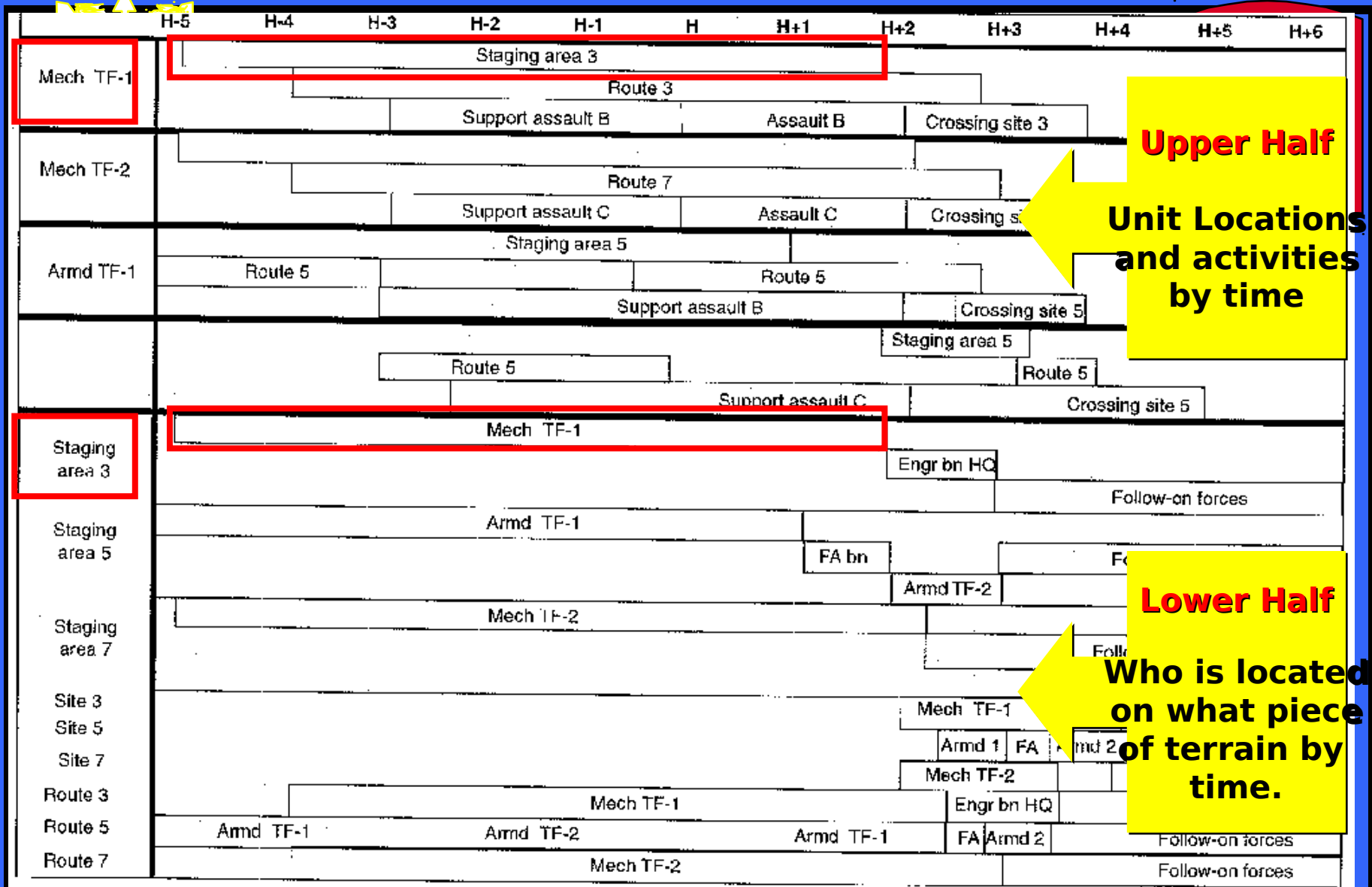
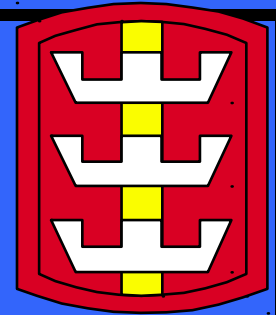


Figure B-7. Crossing-synchronization matrix

	H-3	H-2	H-2	H	H+1	H+2	H+3	H+4	H+5
A/237	Move to site B. Move to site 3.	Prep RB15s. Establish ERPs.	Execute assault-boat operations; assault site B.			Prepare site 3.	Perform route maintenance of route 3. Operate crossing site 3.		
B/237	Move to assault site C.	Position and prepare boats.	Execute assault-boat operations assault site C.			Perform route maintenance of route 7.			
C/237		Move to site 7.	Establish ERPs.		Prepare site 7.	Operate crossing site 7.			
D/237		Move to site 5.	Establish ERPs.		Prepare site 5.	Perform route maintenance of route 5. Operate crossing site 5.			
203 AFB co	Deliver assault rafts.		Move to equipment park 3.		Build rafts, site 3.	Operate rafting site 3.		Construct bridge, site 3.	
204 AFB co	Deliver assault rafts.		Move to equipment park 5.		Construct bridge, site 5.		Operate bridge site 5.		
205 AFB co	Deliver assault rafts.		Move to equipment park 7.		Build rafts, site 7.	Operate		Construct bridge, site 7.	

Figure B-8. Engineer execution matrix

**Subordinate
Units' Task
assignments
by time**



higher column.

4. If the river width falls between 2 columns, use the value found in the next

3. Crossing times will take 20 percent longer at night.

5. Round-trip times include the times required to load and unload the raft.

ditions.

including 1.2 MP2 (2 lbs). This data is based on the use of crews under ideal con-

1. This table is valid for ribbon and MATB rafts in current velocities up to and

NOTES:

3'030	1'500	42	1	e
3'808	1'100	41	1	e
3'580	1'000	38	1	e
5'025	000	32	1	e
5'854	800	35	1	e
5'500	100	50	5	e
1'008	000	50	5	e
1'040	200	54	5	2
1'410	420	55	5	2
1'315	400	50	3	2
1'148	320	18	3	4
004	300	10	3	3
001	503	14	4	3
138	552	15	2	5
010	188	11	2	5
405	120	10	e	5
410	152	0	e	1
358	100	8	1	1
540	12	1	8	1
Feet	Meters	Round Trip Minutes per	per Hour Rounds Trips	Centerline Rafts per Number of
River Width				

TABLE C-8. RAFT-CROSSING CAPABILITIES

Table C-10. Determination of bridge classification

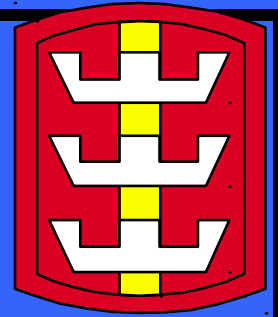
Crossing Types	Current Velocity in MPS (fps) and MLC							
	0-0.9 (0-3)	1.2 (4)	1.5 (5)	1.75 (6)	2 (7)	2.5 (8)	2.7 (9)	3 (10)
Normal: wheeled tracked	96 75	96 75	96 70	96 70	82 80	65 60	45 45	30 30
Caution: wheeled tracked	105 85	105 85	100 80	100 80	96 80	75 65	50 50	35 35
Risk: wheeled tracked	110 100	110 195	105 90	105 90	100 90	82 75	65 65	40 40

Table C-11. Number of boats needed for anchorage of a ribbon bridge

Current Velocity in MPS (fps)	Number of Boats: Number of Bridge Bays
0 to 2.0 (0 to 6.5)	1:6
2.0 to 2.6 (6.5 to 8.5)	1:3
2.7 (9)	1:2
Over 2.7 (over 9)	Bridge must be anchored using an overhead cable sys- tem.
NOTE: Anchorage of ribbon bridges is normally accom- plished by tying BEBs to the downstream side of the bridge. The number of boats required is shown in the table.	



SUMMARY



- **Five general planning steps.**
- **Rules of thumb.**
- **Appendices B and C, FM 90-13.**
- **Basic calculations.**
- **CTLs and initial and final vehicle crossing capability.**